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Modern Tooling Methods for Turret Lathes

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MODERN turret lathe tooling not only increases the production of turret lathes, but at the same time handles a great range and variety of work.

This article and the ones to follow have been prepared to meet the need for practical and concise information about the fundamental principles of modern turret-lathe practice. They aim to show the possibilities of increasing production through the use of better methods, at the same time recognizing the limitations of tool expense in the average shop and, therefore, suggesting tooling that does not require a large investment.

The general plan is, first to discuss the principles, then show their practical application, and finally consider the individual tools. It is the hope that these data will prove of real value to the men responsible for the production of work from turret lathes.

The problems of the individual shop are discussed in this article and suggestions are made for increasing production through multiple cuts, combined cuts, and rigid tooling. The better methods suggested will also reduce the tool cost and lower the set-up time

The problems of tooling for turret lathes vary in each plant because of the great difference in the work produced. Each type of job requires its own standards of accuracy, and each metal used has its own specific problems. But the greatest factor is the variation in the quantities produced in a lot, in the different plants.

The methods of modern quantity-production, as developed in the automotive industry, have revolutionized tooling methods, yet a few only of the many thousands of metal-working plants in this country are really large enough to apply these methods.

The aim of the quantity producer is to equip a standard machine with tools for one particular job. Every effort is made to cut time, even a few seconds, and not very much attention is given to the resulting tool cost. Full advantage is taken of the possibilities of combining cuts, special tools are developed for multiple cuts from one tool, and the equipment is designed with strength and rigidity to maintain accuracy when using heavy feeds.

The tooling cost of such methods is, of course, rather expensive in the small-lot production field, where five to fifty or more pieces are made at one time. Yet the same fundamental principles may be adapted to the work in the average shop. The problem of turret-lathe tooling becomes, therefore, one of applying the principles of combined cuts, multiple cuts, and rigid tooling to the work in each individual shop, without high tool cost and set-up time.

If we can develop tools of an adjustable and universal type that will increase the production, and at the same time will handle a large variety of work, then the problem of the average manufacturer will be solved, and the high tool cost of the quantity producer will be greatly reduced.

Many companies have succeeded in increasing production with a small number of tools that will handle a large variety of work. A study of the tool equipment used in these shops, shows that these same universal types of tools can be applied to the various kinds of work in many thousands of other shops. It is possible to reduce costs with existing machine tools, by the application of the fundamental principles to be set forth in these articles.

The three fundamental principles for increasing turret-lathe production by proper tooling methods, are:

1. *Combined cuts. By taking cuts from both the square-turret station and from the hexagon-turret station at the same time.*

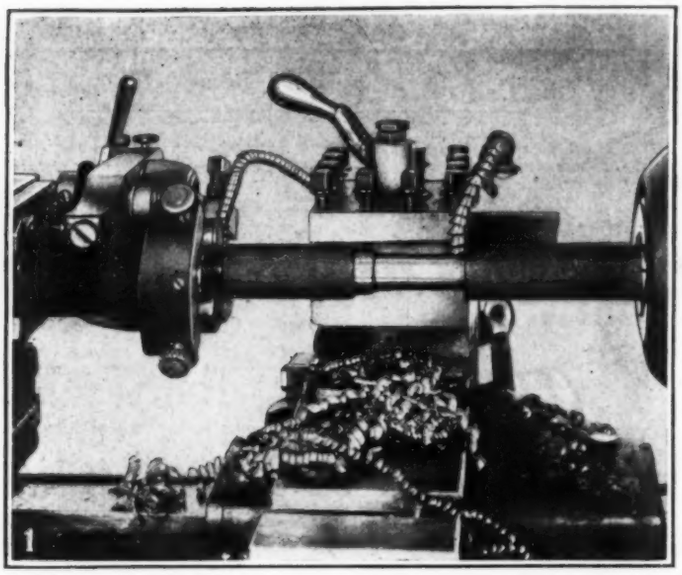
2. *Multiple cuts. Replacing single cuts from one of the tool stations with two, three, or more cuts from the same single-tool station.*

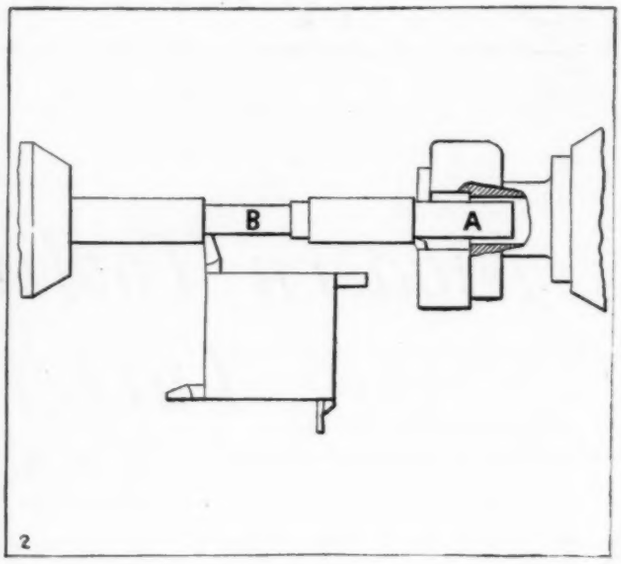
3. *Rigid tooling for heavy feeds. Providing exceptionally rigid tooling that will permit heavy feeds without destroying the accuracy required.*

Not only must production be increased in the average shop, but the tooling methods must not require expensive or special tool equipment for each job. This leads to the use of:

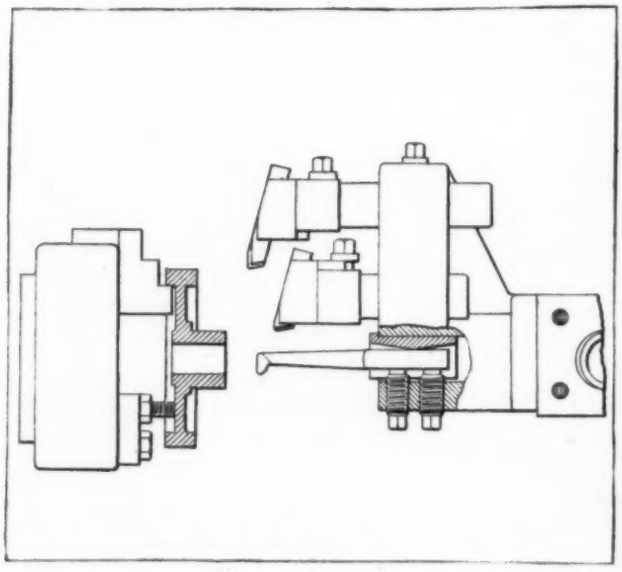
1. *Universal tool equipment that is quickly adjustable for handling a large variety of work.*

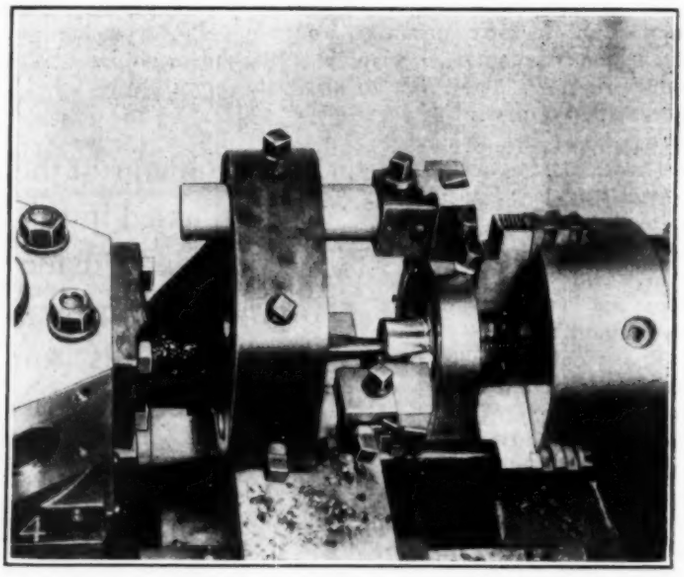
2. *The permanent set-up, to reduce the time of changing over from one set-up to another by using*





Figs. 1 and 2—Combined cuts on bar work





Figs. 3 and 4—Combined cuts on chucked work

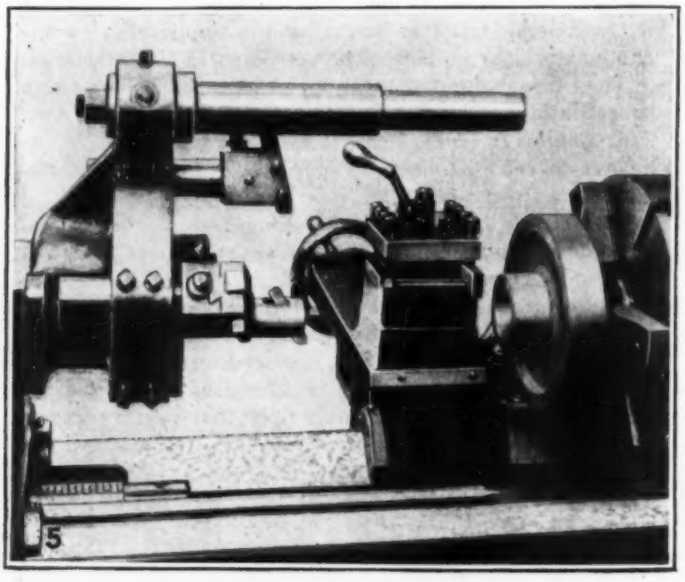


Fig. 5—Tools supported by piloted bar

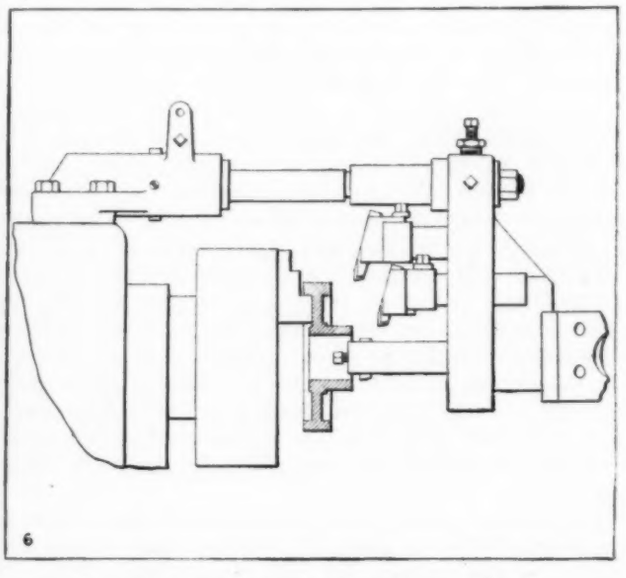


Fig. 6—Arrangement of tools in Fig. 5

this same universal tool equipment.

An example of the principle of combined cuts is shown in Figs. 1 and 2. The tool on the hexagon turret is turning Diameter *A*, Fig. 2, while the tool in the square turret is turning Diameter *B*. This gives two tools cutting at the same time, and reduces the time to almost one-half for a considerable part of bar work.

Further applications of this principle of combined cuts to bar and chucking work will be discussed later.

An illustration of "multiple cuts," as applied to chucking work is shown in Figs. 3 and 4. The worm gear being machined requires two outside turning cuts and an inside boring cut. The tool used for this kind of work holds two cutter holders for the two outside diameters, and also a forged boring cutter for the hole. Three cuts are thus taken at one time with the multiple-turning head.

Increasing the feeds of the machine without destroying the accuracy of the work, requires rigid tooling. Fig. 5 shows a method of machining a gear blank, the outside diameters of which are held to limits of ±0.001 in. The tool is mounted on the hexagon turret and given additional support from the head of the machine by an overhead piloted bar, thus obtaining exceptional rigidity. Fig. 6 shows a sketch of the tools.

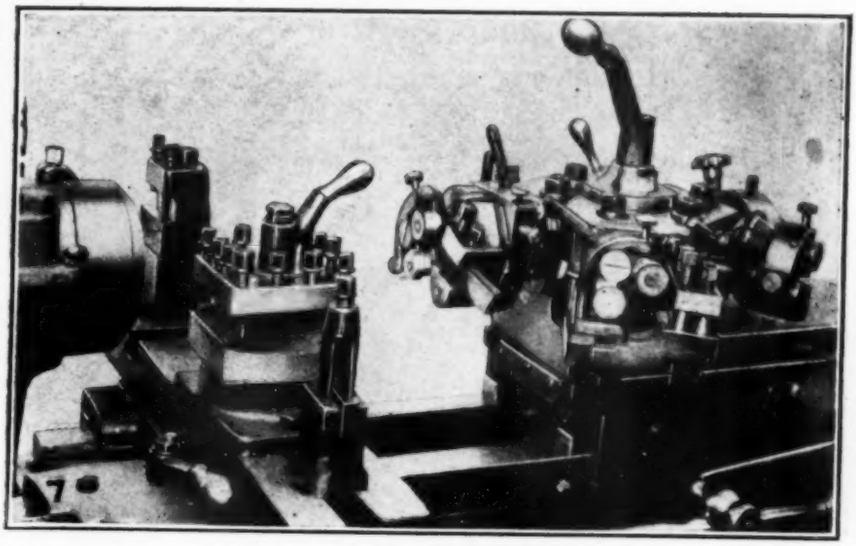
The principles of overhead piloting for rigid tooling, as used in chucking work, will be explained later, and a detailed description will be given of the simple construction of the adjustably mounted pilot bar.

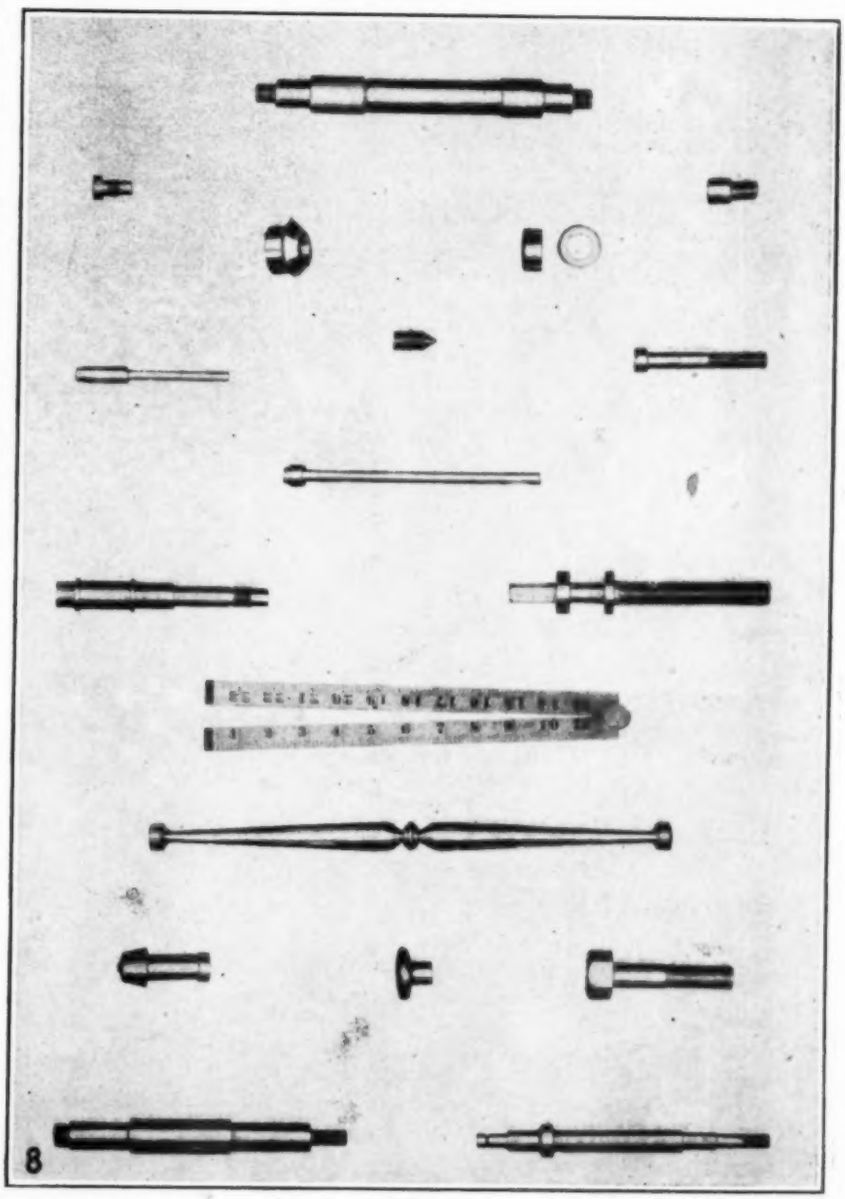
Modern turret-lathe tooling not only increases production, but also reduces the tool cost. The majority of bar-work operations, for example, may easily be classified, and individual tools may be designed to perform each operation on a wide range of work. Thus it becomes possible to develop a complete set of universal tooling equipment, suitable for the majority of bar work, and consisting of the following tools:

Flanged toolholder with combination stock stop and center. Single cutter turner. Multiple cutter turner. End-facing tool. Center drilling tool. Diehead.

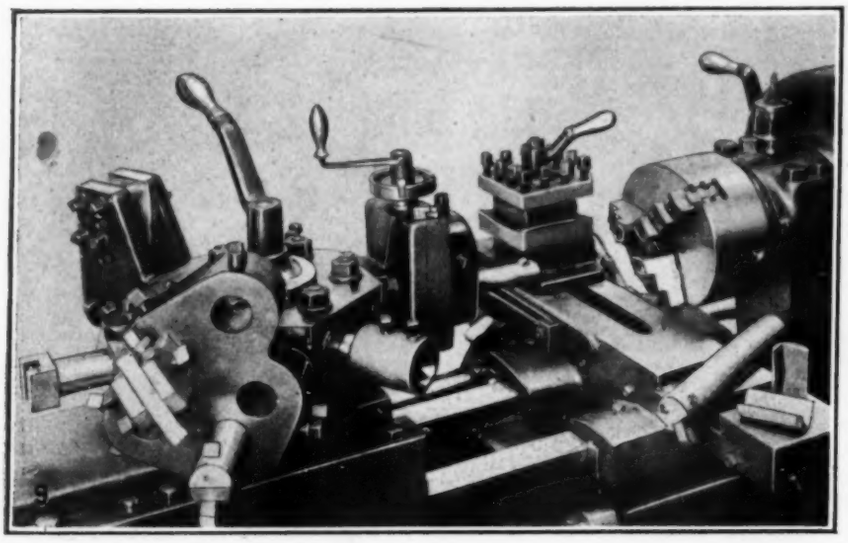
A set of universal tool equipment is shown in Fig. 7, and in Fig. 8 will be seen a great variety of work actually made with this tooling equipment on a 1½-in. bar-capacity machine.

These tools may be permanently arranged around the hexagon turret in a permanent set-up. Then the setting-up time for a job consists only





Figs. 7 and 8—Universal tool equipment for bar work, and some of the pieces produced by it



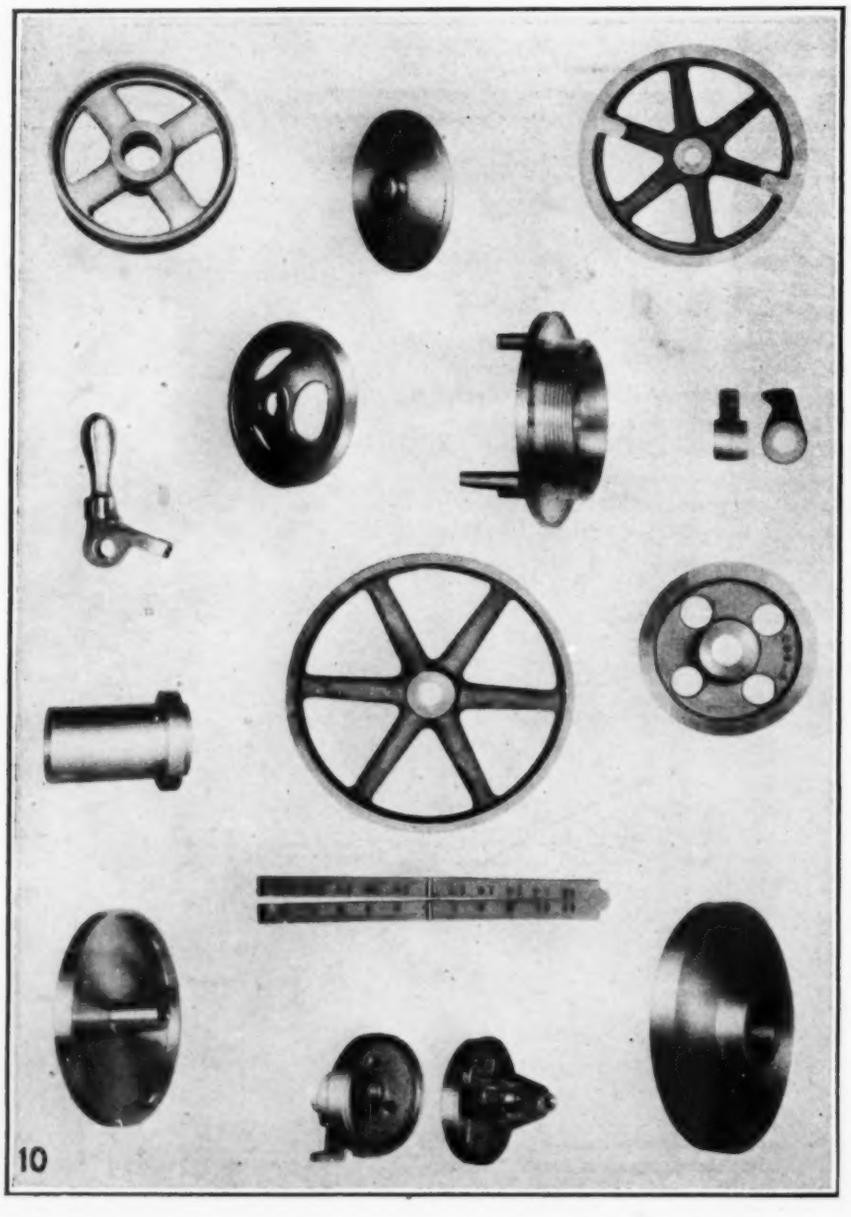


Fig. 9 and 10—Universal tool equipment for chucked work and some of the pieces produced by it

of setting and adjusting the cutters. Fig. 7 shows the permanent set-up for the universal tooling equipment suggested.

Many tooling problems are presented in chucking work, but a wide range and variety of work may be handled efficiently with one set of chucking-tool equipment. A simple set of such tools may be developed for the size of work handled by the machine. Such tooling applies the principle of multiple cuts, gives tool clearances, so that the principle of combined cuts can be used, and also includes the principle of rigid tooling.

To show the possibilities of such a complete set, a universal chucking-tool equipment is shown in Fig. 9, for a turret lathe that will swing work over the cross-slide, up to 8½ in. in diameter.

In Fig. 10, the different types and sizes of work produced with this equipment should be noted. A permanent set-up of this chucking equipment, similar to the arrangement suggested for bar work, may also be used, as shown in Fig. 9. It saves the time necessary for remounting the tools for different jobs, and substantially reduces the set-up time.

In tooling turret lathes for bar work, the problems vary in each plant, according to the type of work produced, but the fundamental principles of increasing production may be applied, whether the quantities are large or small. Always, however, the limitations of tool cost must be recognized, and the effort made both to increase production and to reduce the tool investment.

The object in correct tooling for bar work is to apply the fundamental principles of increasing production, which are:

1. *Choose the right type of machine.*
2. *Select the best tooling equipment warranted by the quantity to be produced.*
3. *Combine cuts wherever possible, so that both the square- and hexagon-turret stations will cut at the same time.*
4. *Use multiple cuts; that is, taking several cuts from each tool station wherever possible.*

In the average shop the methods for increasing production cannot afford expensive or special equipment for each bar job. For economical production, universal tooling equipment, suitable for handling a great variety of work with a low set-up time, is required.

(To be continued)

Automotive Production

Willys-Knight Production Methods

By Fred H. Colvin
Editor, *American Machinist*

Some of the methods that have been developed in cylinder-block manufacture to meet the demand for a large output of sleeve-valve engines

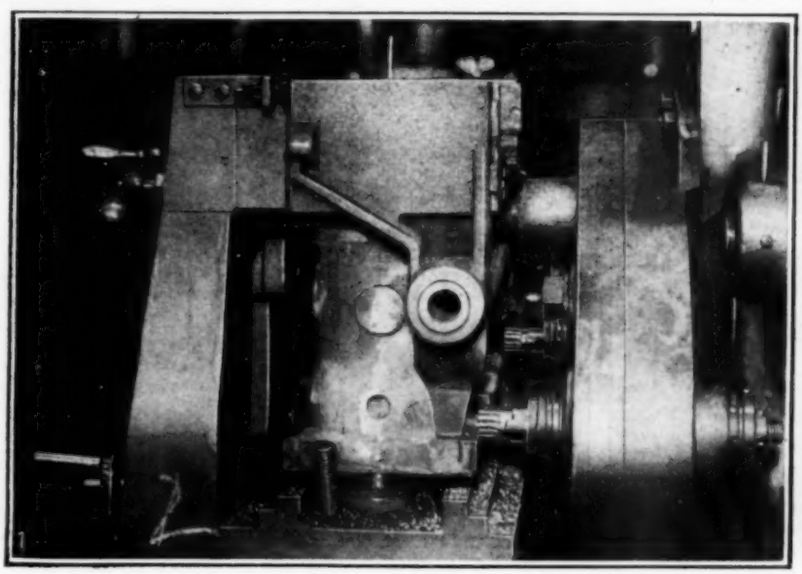
WHILE the Knight engine, with its sleeve valves, presents many manufacturing problems that differ materially from those found in engines of the poppet-valve type, the machining of the cylinder block is quite similar in many ways. The main difference is that the cylinder block is separate from the crankcase, instead of being combined with it, as is the case in many poppet-valve engines.

Cylinder Blocks

This article deals especially with the cylinder blocks of the 4- and 6-cylinder Knight engine, as built for the Willys-Knight car at the Wilson Foundry and Machine Co., Pontiac, Mich. It shows the main operations and gives a good idea of the way in which the cylinder blocks are machined and handled after coming from the foundry.

In common with the processes of many shops, the first operation is to mill three locating points on the side of the cylinder block as in Fig. 1. Two of these pads are just above the bottom flange and the third is near the top. The machine is a Kempsmith, fitted with a special head carrying three spindles and three milling cutters. Each of the lower locating spots has a shoulder to assist in locating the block in future operations as can be seen in Fig. 3, being different from the practices in some shops.

In the 4-cylinder block, Fig. 1, the intake manifold is integral with the cylinder, and, since the location of the parts in the bore is important in the finished engine, the locating spots are milled with relation to the intake manifold, which is used to locate the cylinder block in the fixture of the first operation. By so doing the future milling operations bring the top and bottom of the block in definite relation to the ports, so that when it comes to the milling of the ports, they will be prop-



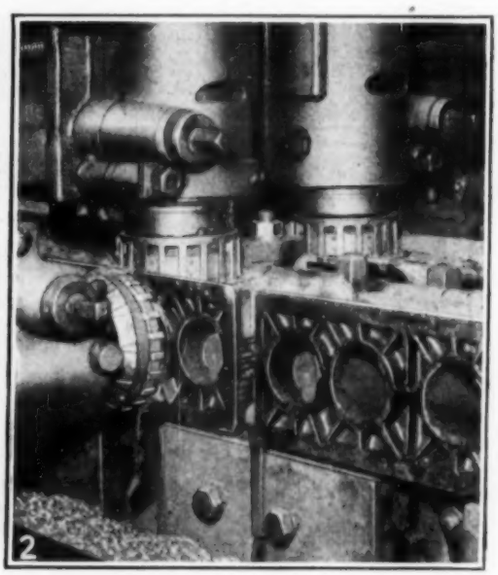
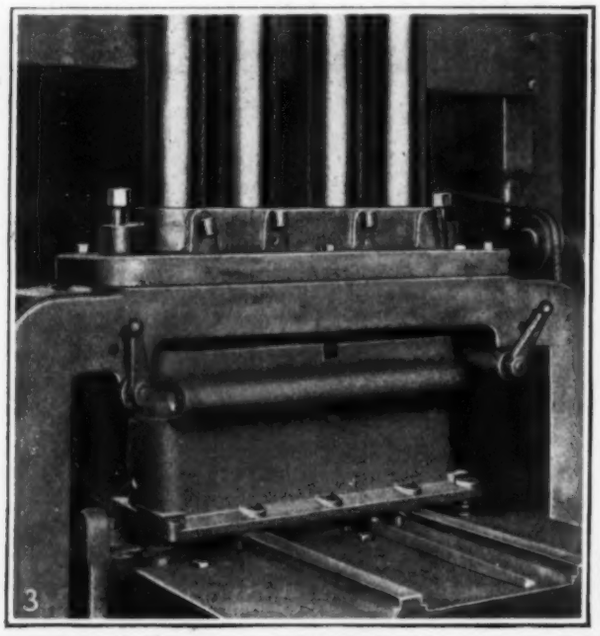
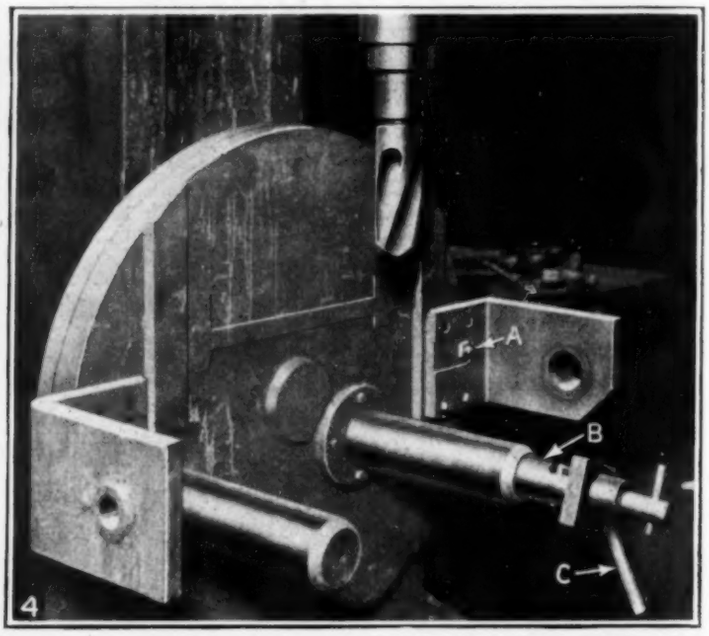
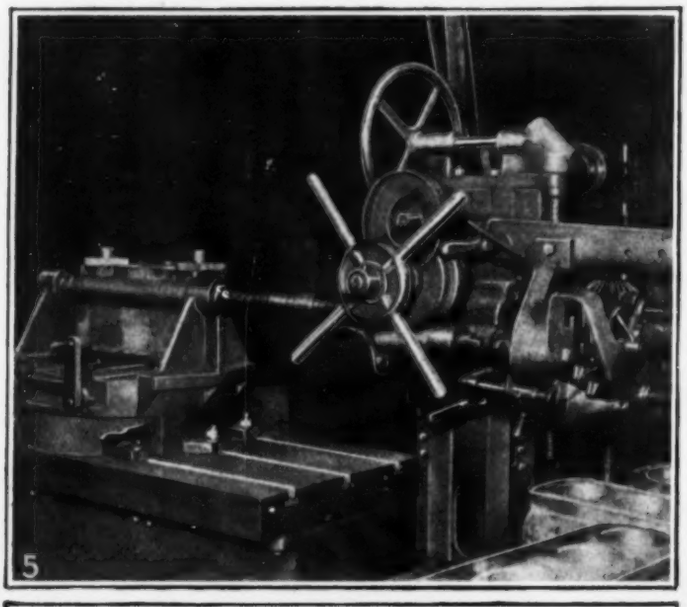


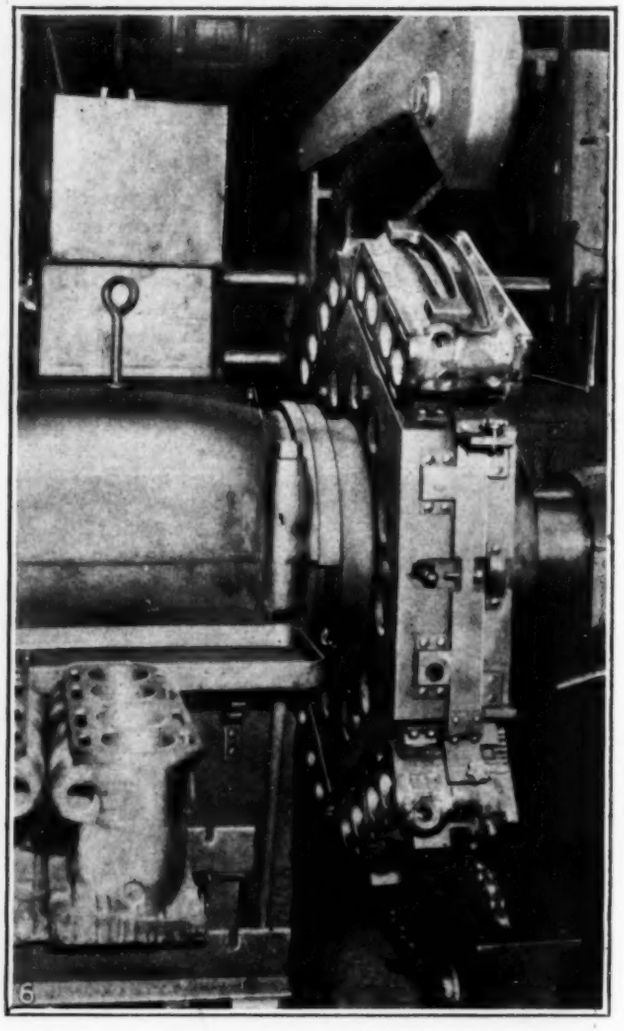
Fig. 1—Milling three locating spots. Fig. 2—Milling a double row of blocks

Automotive Production









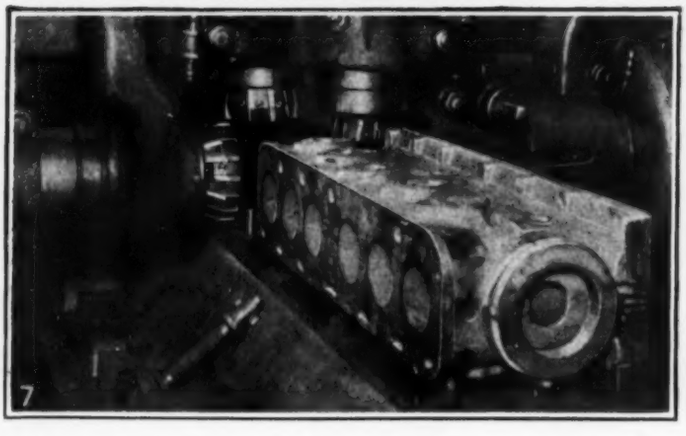


Fig. 3—Boring a 4-cylinder block. Fig. 4—Indexing fixture for rough-boring intake. Fig. 5—Finish-boring intake manifold. Fig. 6—Finish milling tops and bottoms of cylinder blocks. Fig. 7—Milling 6-cylinder blocks

Automotive Production

erly located in their position in the intake chamber.

The bottom of the cylinder block is ribbed, as can be seen in Fig. 2, and that part is painted before it, the tops of the bolt bosses and the surfaces that receive the exhaust manifold, are milled. In these operations the block is located against the shoulders previously referred to. Clamping bars in the cylinder bores hold the blocks firmly on the locating surfaces and against the thrust of the cutters. In addition, there are short straps between the two rows of blocks.

A somewhat similar milling operation is performed on the other end, and the other bolt bosses are also milled. Then comes the water test, the device being shown later in connection with the 6-cylinder block. Next, the two locating holes in the base flange of the block are drilled and reamed. These holes are two of the bolt holes used in attaching the block to the crankcase, as is rather common practice.

The cylinders are rough bored on the Foote-Burt machine shown in Fig. 3, this view showing the type of fixture and the locating spots and holes in the lower flange. The block is held by clamps operated by levers.

After rough boring the cylinders, the ends of the intake manifold are rough bored under a vertical drill on the fixture shown in Fig. 4. The block is slipped over the two large studs and located by two dowels, one of which is shown at *A*, in the guide bracket. The block is held by the quick-acting, bayonet-joint bolt at *B*. The cross-pin in the end of the bolt slips into the extension on the stud, and is held in place while the lever *C* is used to tighten the block in position.

The final boring of the intake manifold is done on the Rockford machine in Fig. 5, by means of the boring bar and fixture shown. The fixture is a horizontal turntable, in which the block is located as before. The boring bar is guided by a slip bushing that fits the larger end.

A final milling operation on both the top and bottom of the cylinder block on a Davis rotary machine, is shown in Fig. 6. This view was taken from the back

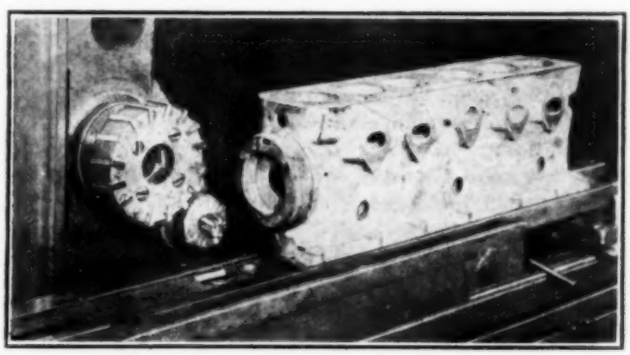


Fig. 8—Face milling the other side

or loading side of the machine, the milling cutters being at the front. The blocks are positioned on the faces of the rotating drum by the pads and the stud shown, and held lightly in place by a small hand screw. The real clamping of the blocks is done by the regular Davis method, utilizing a flat, link chain under tension, for holding the work during the cut. Shoes are laid over each cylinder block to afford a suitable contact for the holding chain. In certain cases the top and bottom faces of the blocks are ground.

After an inspection, the cylinders are reamed to 4.095-4.096 and the bottoms of the bores chamfered. Then the ports are milled in the cylinder walls to admit the explosive mixture from the intake chamber,

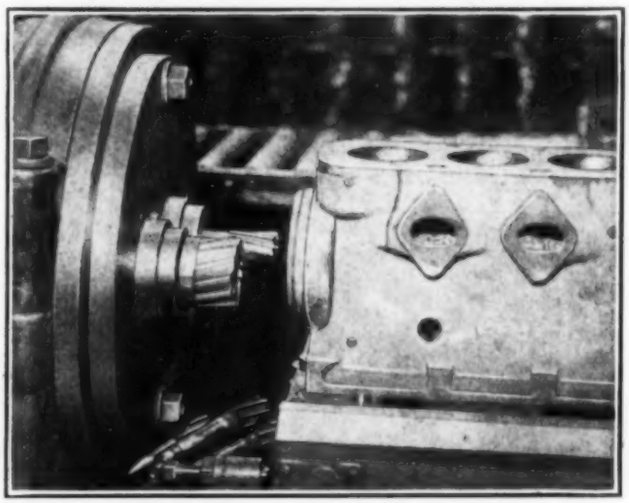


Fig. 9—Rotary milling for pump seat

after which another water test is made to be sure that no leaks have been developed by the machining operations.

A finish-reaming operation follows, the final finish being by honing or lapping, using a hone having eight comparatively narrow blades, each blade being relieved in the center, so that it presents two narrow surfaces to the cylinder bore. The honing is done on a Foote-Burt machine and all bores are honed at one operation.

The machining of the block of the 6-cylinder engine is very similar in most respects to the operations on the "four." There are, however, a few variations due to the differences in the design of the block.

Instead of casting the intake manifold on the cylinder block as in the 4-cylinder, it is bolted on as is the case with the usual poppet-valve engine. Three of the milling operations are illustrated herewith. In Fig. 7, the top, bottom and one side are milled on an Ingersoll machine, using four cutters. The smallest cutter surfaces the tops of the bolt bosses, while the other cutter on the vertical spindle, mills the pads that receive the intake manifold. The other side is milled on the Cincinnati machine shown in Fig. 8, with the block in a vertical position. The large cutter handles the manifold faces, while the combination cutter mills the top of the bolt bosses and the side of the flange.

The other milling operation, Fig. 9, shows the milling of the seat for the water pump, on a special Newton rotating head machine. The small cutter mills the inside of the projection while the larger cutter faces the surface. This operation is one of boring and facing that would formerly have been done on a lathe or boring mill.

The water testing device is shown in Fig. 10.

Automotive Production

Hydraulic cylinders replace the old hand-clamping methods and save considerable time in handling the cylinder blocks in the testing operation. The heavy rubber pad on which the top of the cylinder block rests, insures a tight joint and has a long life. As with all

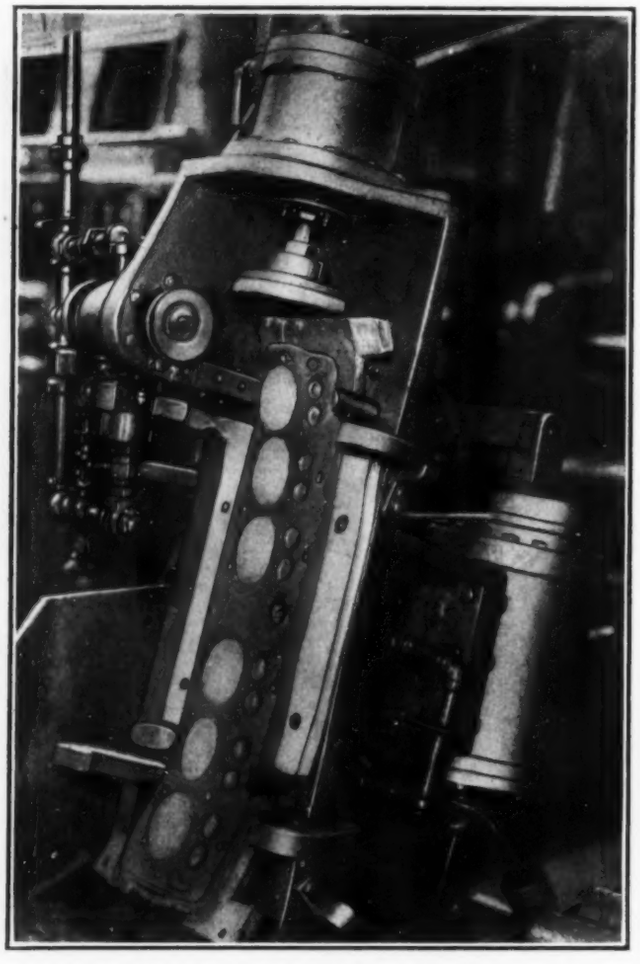


Fig. 10—Water-testing apparatus

the operations, the testing stand is served with a roller conveyor of convenient height, so as to reduce handling to a minimum.

In a general way, the cutting speeds of boring-bar cutters are about 80 ft. per minute when roughing and half of that for the finishing cuts. The roughing cutter removes approximately $\frac{1}{8}$ in. of metal on a side, the next cut takes $\frac{1}{16}$ in. while the finishing cuts are from 0.012 to 0.015 in. Honing does not enlarge the bore over 0.0005 in. The rough-boring feed may be given as $\frac{1}{32}$ in. per rev., being reduced to $\frac{1}{64}$ in. for finishing.

Milling speeds run from 100 to 120 ft. per minute for Chesterfield, a non-ferrous alloy, and about 60 to 75 ft. per minute for high-speed steel. The feed, on cylinder blocks that can stand heavy cuts, averages perhaps 15 in. per minute with a maximum of 22 in. under the most favorable conditions.

American industry has the open-door policy, European the closed. Take your pick according to results.

Abstracts

from other publications

Making Aero Engines

One of the well known airplane engines made in England is the Napier made by the Napier Co. of London. This engine is built to rigid and accurate standards. The main crankcase castings for example call for considerable skill in production. The sides of the crankcase are thin, since they are really only oil containers, and after they are cast they naturally cool and contract quicker than the heavy cross-webs which carry the main bearings. Consequently to prevent the cases from cracking in cooling the sides have to be kept hot with blow-lamps while the heavier parts are cooling off.

At each stage of the machining of these aluminum parts they are subject to what is called the hot water or kerosene test to determine whether there are any holes or cracks in the metal. Kerosene is found the better test since it will seep through a hole which is practically air tight. If a crack or hole is discovered, the casting is scrapped.

The process of producing the cylinders from a cylinder blank that looks like a big flower pot and weighs 100 lb., is of interest since in the finished state it weighs 10½ lb. A great deal of money could be saved both in the size of the blank and in the amount of machining, if the company were content to weld the sparkplug lugs into the cylinder walls as is the common practice in other forms of engines. Experience proved that the welded lugs were apt to crack at the weld so the whole cylinder is machined out of the solid.

Crankshafts are, however, not machined out of the solid, but come as forgings bent with all cranks and crank-pins in their proper position. The cost of forging a crankshaft from a steel bar is considerably more than the cost of machining it from a solid block, but the reason for doing this work is that the grain of the steel follows the various curves in the bar steel. Incidentally the German engines had many broken crankshafts during the war due to their being machined from the solid. All holes of the crankcase are reamed and polished inside as it is found if a scratch or tool mark is left, it is enough to break the shaft under heavy running conditions.—*The Aëroplane* (England), Dec. 9, p. 660.

Alloy Steel

C. J. Stark, president of the Penton Publishing Co., states that last year the automotive industry consumed approximately 3,200,000 gross tons of rolled steel. Of this total probably 15 to 20 per cent was of alloy quality. The percentage varies with the individual manufacturer. On this general basis, the automotive industry today is using 50 to 60 per cent of all the commercial alloy steel produced, and practically all of it is heat-treated.—*Transactions of American Society for Steel Treating*, Dec., 1925, p. 723.

Maintenance of Motive Power on New England Railroads

By Ellsworth Sheldon
New England Editor, *American Machinist*

Machining shoes and wedges—A system of obtaining dimensions that does away with the transfer of individual measurement—Motion work—Time and labor saving devices

IN A preceding article, reference was made to the fact that in the Readville shops of the New Haven road, the driving boxes for locomotives are always planed to a standard dimension between the shoe-and-wedge faces. The original size is, of course, an arbitrary one, determined by the builder of the locomotive, but when the boxes have to be redressed because of wear, the dimension is reduced to the first ½-in. division of the scale that will allow the most badly worn box of the set to clean up. This system saves an infinite amount of measuring and transfer of measurements in planing shoes and wedges.

There is but one pair of patterns for shoes and wedges for each kind of engine, and the thickness of the casting is sufficient to compensate for the low limit to which a driving box is allowed to be planed. Thus, for a new box there will be a considerable amount of metal to be removed from the shoe and wedge in the final planing, while for a box that has been reduced to the limit there will be but little.

Working Combinations

The first job of planing shoes and wedges is really a manufacturing operation. They are held by fixtures in the planer shown in Fig. 1. Six shoes and seven wedges (or any combination of equal length) are machined at one loading. The fixtures consist of a number of T-sectioned pieces that when placed end to end of the planer extend the full length of the table. Their upper faces are planed to fit the rough castings as nearly as possible, holes are drilled in them at intervals, and cored pockets in the web accommodate the nuts of the clamping bolts.

To hold the work on the fixture, there are rectangular blocks of hardened steel, each having one serrated face. Two of these blocks are placed back to back (in the making) and a tapered hole is machined along the joint so that one-half the diameter of the hole is in each block. When a pair of these blocks is placed between a pair of the castings to be planed, a correspondingly tapered bolt set into the hole—passing through one of the holes in the face of the fixture and secured by a nut in the pocket of the web—the tendency is not only to draw the blocks and work down firmly upon the face of the fixture, but to spread the blocks apart and thus hold the work by end pressure.

The job with which the operator of the planer in Fig. 1 is concerned, is to plane the surface that is to bear against the yoke of the engine frame, plane the inside of the flanges (which dimension he gets from the drawing of the particular type of engine upon which the parts are to be used), and to dress the outsides of the flanges, also, to drawing size. The amount of metal that he takes off the bearing surfaces is as little as is necessary to clean up the string of castings. The

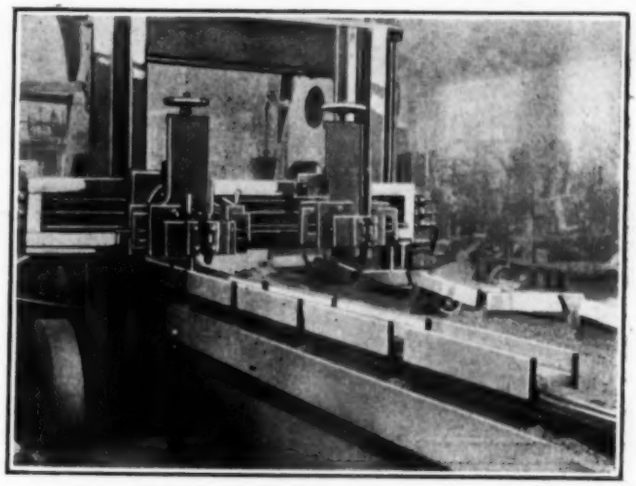


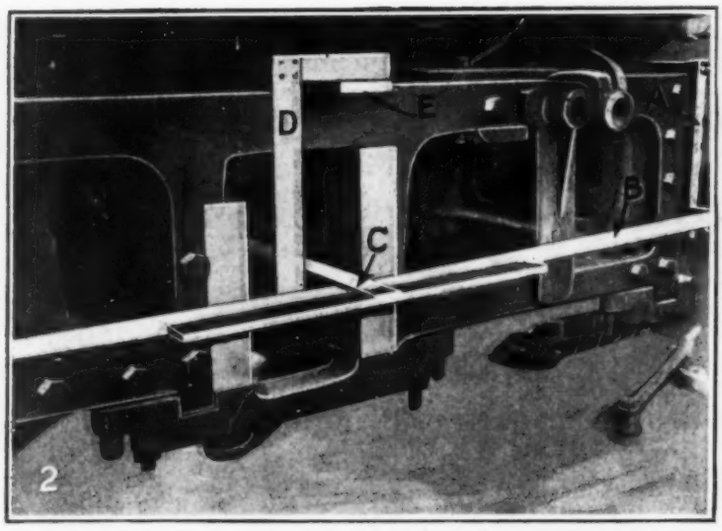
Fig. 1—Planing shoes and wedges for stock

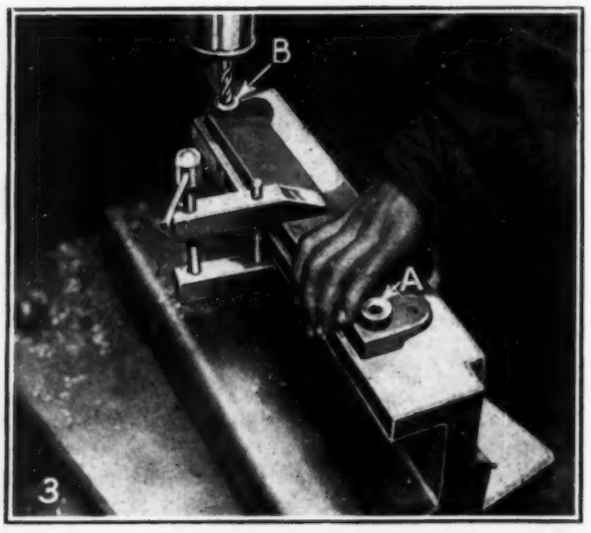
shoes lie flat on the fixture, the wedges being tilted to the angle of their bearing surfaces and set by means of a level to line with the travel of the tool point.

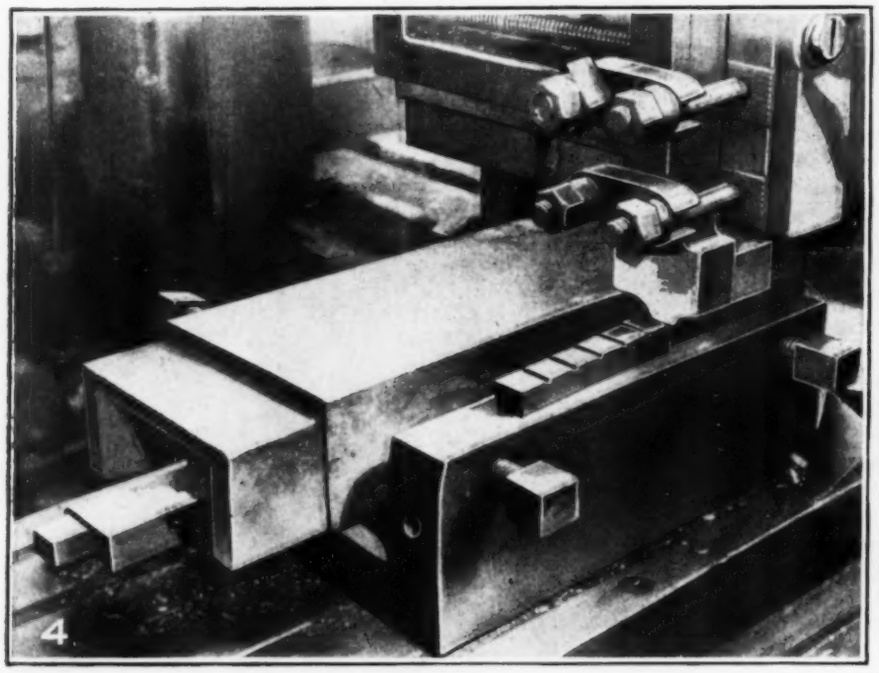
The set-up to lay off the shoes and wedges is shown in Fig. 2. Two or more brackets *A*—the number depending upon the length of the engine—are clamped to the frame, and upon the lower projecting ledges of these brackets a long steel straight-edge *B* is laid. The bearing surfaces of the ledges have been machined to the proper height to cause the straight-edge to lie parallel with the longitudinal center line of the frame in a horizontal plane, and the ledges of the two end brackets have small shoulders against which the straight-edge is placed to bring it parallel with the frame in the vertical plane. The intermediate brackets, when used, are merely supports to prevent the straight-edge from sagging of its own weight.

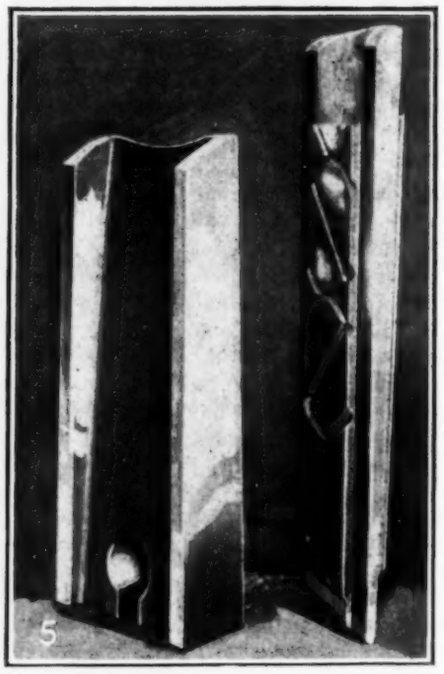
The set-up is duplicated on the other side of the engine at the same time, and the first duty of the layout man is to ascertain if the two long straight-

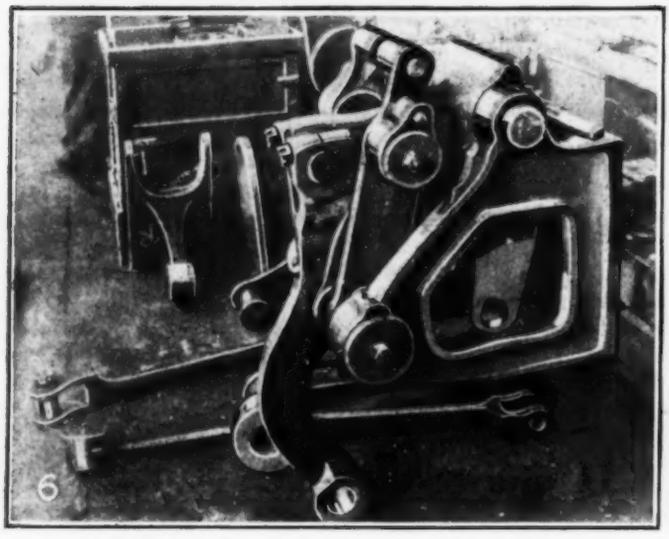
The second article. The third will be published in an early issue.











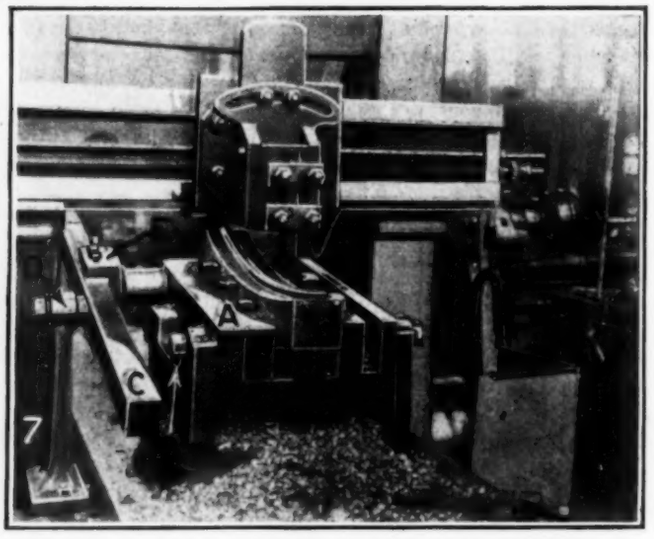


Fig. 2—Laying off shoes and wedges. Fig. 3—Drilling for holding fixture. Fig. 4—The planing fixture. Fig. 5—The Franklin floating wedge. Fig. 6—Baker gear on test stand. Fig. 7—Planing link-blocks for Stevenson gear

edges are parallel with each other, which he does by careful measuring between them at opposite ends. If the frames of the engine are parallel, the straight-edges will of necessity be parallel also, but if there should be error in the placing of the frames, it is divided between the sides and compensated for by shimming between the straight-edges and the shoulders of the supporting brackets.

With a steel tape and working from the drawing dimension of the engine as taken from the tabulated cards in the office, the layout man measures off the distance from the face of the cylinder to the theoretical center line of the main driving axle and scribes a line across the chalked surface of the straight-edge at that point, repeating the operation on the other side of the engine. Now when the T-square *C* is laid across the two long straight-edges, passing through the main yokes, its blade should coincide with both marks.

Working from "Card" Size

By means of the try-square *D*, hanging from a wide straight-edge *E* that is laid across the tops of the engine frames, the center line is transferred to the frame above the yoke, and a prick-punch mark made on this line becomes the point of departure from which to lay off the shoes and wedges for the main as well as all other yokes. Still working from the "card" size—there is no transfer of measurements at any time—there is laid off on the engine frame above the yoke a distance before and behind the center line that is one-half the card dimension of a new driving box, plus the normal thickness of the shoe and wedge, plus $\frac{3}{8}$ in. This may be done with dividers or trammels.

The try-square and straight-edge are then requisitioned to lay along the chalked flanges of the shoe and wedge, vertical lines to coincide with these two points. The shoe and wedge are held in place in their respective yokes by a jackbolt set out between them. Upon each of the lines so obtained two deep prick marks are made at a definite distance apart and of approximately equal spacing each way from the center, lengthwise of the casting.

Having completed the layout upon the shoes and wedges in both main yokes, the paraphernalia may be taken down and returned to the toolcrib. By means of long trammel bars, the locations obtained as above described are then transferred to the corresponding parts in the remaining yokes of the engine. The distance is in each case the center to center distance of the crank-pin bearings in the side rod that connects that particular pair of drivers, and is always taken from the card—never from the rod itself.

It will be observed that at no time has the layout man taken cognizance of what the actual dimension of the repaired driving boxes may be, nor yet of any possible departure from standard of the actual center distances between the yokes of the engine frame. He is not concerned with them. It is his job first to locate the theoretical center line of the main driving axle and then to lay off from it the basic lines from which the actual working faces of the respective shoes and wedges may be machined.

When the shoes and wedges were delivered to the job, they had been taken from stock and belonged only to a certain type of engine. When the layout man has finished with them they belong not only to the individual engine but to the particular yoke of that engine in which they are laid out. It is very necessary, therefore, that they be ineffaceably marked with the engine number, the yoke number, and right or left as the case may be. The marking is done with steel letters and figures.

The layout man's job is finished only when he has drilled two small holes in each side of each shoe and wedge. On the line that he has transferred from the yoke to the casting he has made two deep prick marks at a definite distance apart, as before noted. The exact location of the marks relative to the length of the casting is not material but they must be on the line and the correct distance apart. He then takes the jig shown in Fig. 3, sets the sharp points opposite *A* and *B* into the prick marks, clamps the jig in place and proceeds to drill, through the bushings, two $\frac{7}{16}$-in. blind holes in the flange. The shoe or wedge is then placed in a box jig which locates it from the yoke-face and from the holes just drilled, and two corresponding holes are drilled in the opposite flange.

The fixture shown in Fig. 4 is the reason for the foregoing procedure. It locates the shoe or wedge entirely from the four small holes just drilled, by means of studs on the ends of the four large setscrews by which the work is clamped. These studs are slightly tapered so that they will enter the holes without difficulty, yet will hold the work firmly when the screws are tightened.

It will be remembered that the dimension between the shoe-and-wedge faces of the driving box is planed to regular increments of $\frac{1}{4}$ in. as redressing becomes necessary, and that all boxes of a set are planed alike. If the boxes are new they are designated No. 1. If replaned but once and the reduction was but $\frac{1}{4}$ in. they are No. 2. If planed twice with $\frac{1}{4}$ in. reduction each time, or if planed but once and it was necessary to take off $\frac{1}{2}$ in. to clean up the most badly worn box they are No. 3, and so on to the allowable limit of reduction.

Guided by the Reduction Number

When the operator of the machine shown in Fig. 4 gets an order for a set of shoes and wedges for a certain engine, he is concerned only to know that he has the castings that were laid out on that engine, and to get from the driving-box department the number—the *reduction* number—of the boxes for it. He does not care what the actual size may be, nor whereabouts in the engine they are to go.

If the driving-box department informs him that the boxes—for engine No. 138, let us say—are No. 1, he sets his planing tool to the lowest step of the stepped gage to be seen in Fig. 4 lying on the fixture. (Incidentally the gage in the picture is on top of the planed surface of the fixture, right where it is to be used.) If the boxes are No. 2, or No. 3, he sets the tool to the second or the third step accordingly and trusts to the system to bring the measurements right. The parts when he gets through with them may be thick or thin as the case may be, but they always fit the place where they are to go.

The Franklin floating, or self-adjusting, wedge, shown in Fig. 5, is a device to maintain automatically the fit of the driving box in the yoke without causing it to bind. It consists of two parts, one of which fits the yoke as does the ordinary form of wedge, but presents toward the driving box a face that is tapered $\frac{1}{16}$ in. to the foot. Between it and the box is the floating wedge, tapered to correspond to the main wedge and

thus presenting to the driving box a face that is parallel with that of the shoe.

The length of the floating wedge is about $\frac{1}{16}$ in. less than the distance between the top of the yoke and the binder at the bottom. The jar of the engine in motion causes the floating wedge to settle down to the lowest point that its range of movement will allow, at which point, if the adjustment of the main wedge is correct, there will be no lost motion or backlash of the box in the yoke. As the box rises and falls in the yoke, because of the flexing of the carrying springs of the engine, the floating wedge is being constantly loosened and is as constantly readjusting itself, the theory being that there will be no backlash of the box in the yoke so long as there is no vertical movement, but that the box will be able to free itself instantly as the swaying of the locomotive makes it necessary.

Next to the driving-box department is the department of valve gears, or "motion work." As the New Haven is an old road there are all kinds of gear represented, including Stevenson, Walschaert, Baker and Southern. Fig. 6 shows a testing frame in the motion department that is kept there for the purpose of setting up the Baker gears and trying them out before they are sent to the erecting floor to be assembled into an engine. The several members of a newly repaired gear are shown in place.

There are in this department some ingenious devices that have been evolved to forward the work. One of them, shown in Fig. 7, is a fixture to make link-blocks for the Stevenson type of gear. A bar of material about 24 in. long is planed on both sides to the required radius and is then cut up into the lengths requisite for the blocks.

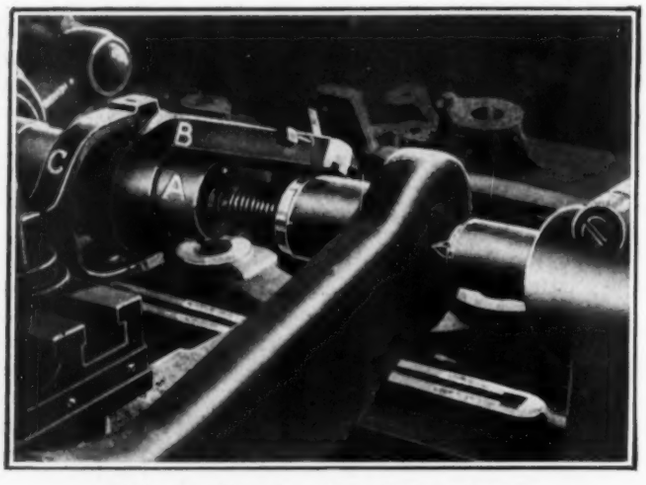


Fig. 8—Turning trunnion on lever

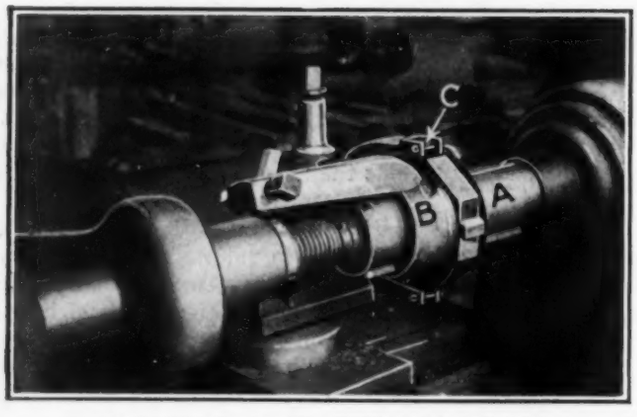


Fig. 9—Another view of lathe fixture

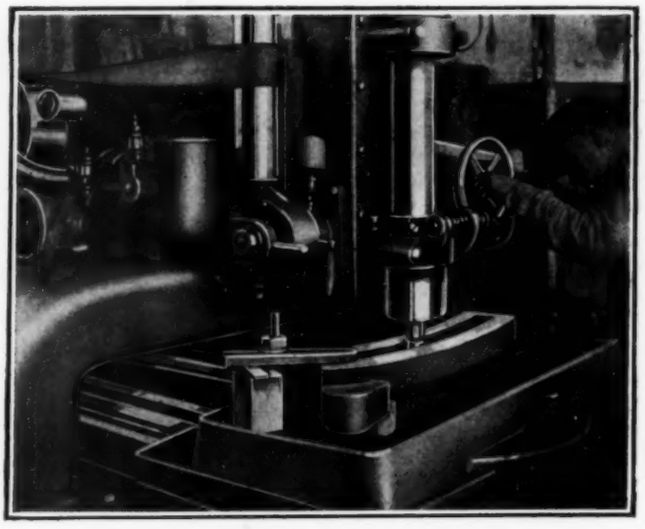


Fig. 10—Grinding a reversing link

The base of the fixture is bolted to the table of a small planer and has no movement except as the table moves. The vise *A* is pivoted at *B* to swing in a vertical plane and is confined against sidewise movement by the side-walls of the base. A square-sectioned bar *C* is held by a trunnion *D* to the bed of the planer and has no movement except that it may be tilted to adjust it to whatever angle may be necessary to produce the desired radius on the work. The end of the bar where it extends behind the cross-rail of the planer, is secured by a clamping bolt to a quadrant that is immovably attached to the inner face of the planer housing.

The guide *E* swivels upon a stud extending from the side of the work-holding vise at the end opposite to the trunnions, and slides upon the stationary, inclined bar. The angle of the bar being adjusted by moving the clamping bolt along the fixed quadrant to a position to impart the desired radius to the work—the quadrant is graduated to facilitate setting—the planer is set in motion, causing the front end of the vise to rise and fall as the guide passes back and forth over the inclined bar, with the result that the stationary tool point considered in relation to the moving work describes a truly circular arc.

To prevent the racking action that might be expected from the fact that the swinging movement of the vise is derived from a relatively fixed point so far to one side of the support, there is on the front end—out of sight in the picture—a rack-and-pinion arrangement that effectively prevents any unequal strain from this cause. The front end of both side walls of the base are machined to a radius and cut with gear teeth. A transverse shaft, taking its bearings in bosses cast on the under side of the swinging vise at this end, has a pinion keyed to each end to mesh with the segmental gears thus formed.

Any sidewise tilting of the vise would thus involve twisting the pinion shaft, and it is of ample proportions to resist any such tendency. To facilitate setting the device to different radii, the projecting end of the pinion shaft is squared to receive a wrench, or crank handle. With the clamping bolt loose in the quadrant, the vise may easily be cranked up or down to the desired setting.

Some of the levers of the Baker valve gear are made

to swing upon trunnions that are in one piece with the lever, and to turn the journal by swinging the lever would involve the use of a very large lathe to turn a comparatively small job. Figs. 8 and 9 from the front and rear of the lathe respectively, show how it is done in a small lathe.

The bar, *A*, Fig. 9, has a shank to fit the taper hole in the lathe spindle, and itself has at the outer end a taper hole to take the displaced live center. The tool-carrier *B* is splined to bar *A* so that it must revolve with it but is free to slide lengthwise thereon. Part *C* is a yoke in which the carrier is free to revolve, but which is confined between collars on the carrier, so that when the yoke is moved lengthwise of the lathe the carrier must move with it.

The lever is mounted on the lathe centers, as may be seen to better advantage in Fig. 9, the large end resting upon a piece of wood laid on the lathe shears to prevent injury to the latter. The shank of the yoke *C* is held in the toolpost of the lathe carriage. When the lathe is set in motion, the tool in the end of the long arm of the carrier sweeps around the stationary work, and may be fed along in either direction at will of the operator by engaging the apron feed of the lathe.

In these days of high steam pressures and consequent heavy loads upon all parts that have to do with moving the valves of an engine, many parts of the motions that used to be made of mild steel and left in their natural state, are now made of alloy steels and heat-treated. Therefore grinding is the logical method of finishing them.

Among these parts are the reversing links of the Walschaert and Southern gears. In Fig. 10 may be seen a Newton link-grinding machine upon which this work is done. This machine is a vertical spindle grinding machine having upon the traversing table a swiveling fixture the movement of which is determined by the position of a clamping bolt along a radius bar that extends to the rear.

Seen and Heard—Discussion

BY JOHN R. GODFREY

In an article by R. L. Irvine, under the title given above and published on page 45, Vol. 64, of the *American Machinist*, Mr. Irvine appears to take exception to my original article.

I didn't suppose for a minute that the Navy specifications *meant* that only those now supplying the department could receive an order. I only quoted what they *said*. Mr. Irvine admits this with his "as I understand it" in the third paragraph.

No one wants the Navy to buy unsuitable material. The desire is to have the specifications say what they mean clearly, and be guided by engineering reason instead of tradition and prejudice.

The whole thing hinges on the interpretation of the term "service tests." If this means samples submitted for tests, as it probably does, it is perfectly proper. But the first impression of every man to whom I have shown this clause, justifies the simile to the "tight boots."

I am also informed on what seems to be good authority, that the specification referred to was replaced in 1922 by a new one that leaves no doubt as to its meaning. It is just possible that this came about because the old one was not clear, as I pointed out. The strange thing is that the old specification should have been sent out by the Navy in 1925 and Mr. Irvine and several others do not seem to know that the one criticized was abandoned three years ago.

It has been my privilege to have close and friendly dealings with the Navy Department, including secretaries, admirals, etc., and I have the highest regard for them all. But an outside engineer often can see opportunities for improvement that are not clear to those who are in daily contact. The seventh and eighth paragraphs of the article should show that there was not the slightest animus in the criticism. I could, if necessary, dig up a number of letters from those fairly high in authority who do not consider my criticisms destructive and who rank me as a loyal supporter, as proposed by Mr. Irvine.

Standardization of Locomotive Reamers

LOCOMOTIVE-FRAME and rod reamers have been made in such a variety of styles and sizes that their design has created discussion among railway tool foremen. Nearly every railroad shop has had a leaning toward some special design of reamer, feeling, of course, that its design is the best.

Such a condition naturally is not aiding standardization, whether the reamers are home-made or purchased on the outside. If a small tool manufacturer receives an order for several reamers from various shops, all of which must be made to different specifications, the cost of producing the tools will be much higher than if it were possible to manufacture tools on a quantity basis.

To overcome this condition, a meeting of the standardization committee of the American Railway Tool Foremen's Association, in co-operation with a committee representing small tool manufacturers, held a conference in Chicago, Ill., on September 3 and adopted the standard forms of locomotive frame and rod reamers shown in the illustration. The specifications call for

Details of standard locomotive reamer

two styles, the four-groove twisted type and the six-groove milled type, both of which are to be made of high-speed steel.

The following specifications are embodied in the designs:

Range of sizes: 1 to 2 in. in diameter in steps of $\frac{1}{32}$ in.

Standard Lengths: 8, 12, 16, 18, 22 and 26 in.

Taper: $\frac{1}{16}$ in. in 12 in.

Spiral: Left-hand spiral, 12 to 20-deg. angles.

Shanks: Shanks are to be square in sizes of $\frac{7}{8}$, 1, $1\frac{1}{4}$, and $1\frac{1}{2}$ in. The length of the square is to be 25 per cent longer than the distance across the flat.

Finish: Flutes are to be machine ground to obtain an accurate spiral. The cutting edge is to be ground with a double relief and recessed at the shank end to provide a run-out for the grinding wheel.

Materials: High-speed steel.

The Super's Plaint

By D. C. Wright

THE boss he called the super in
And says, "I want to know,
Why all our jobs keep piling up;
Why deliveries are slow.

"Our volume's not so very great,
In fact our gross is small;
Yet every job we ship is late—
It will not do at all.

"When I was superintendent
Some fifteen years ago,
Before you came, a promise meant
The goods were sure to go.

"But lately work seems dragging,
And customers complain;
So, though I dislike nagging,
I wish that you'd explain."

THE super sat and took it
With a sort of musing grin,
And when the boss had finished
He sat up and started in.

"Now, boss, you've sure expressed it,
In a fair and proper way,
And since you have confessed it,
You'll let me have my say.

"It's true that things have dropped behind,
Since you advanced to boss
And hired me as your super—
On some jobs there's been loss.

"But if you'll spare an hour or so
And come with open mind,
I believe that I can show you
Just what makes us fall behind.

"Now, remember, I'm not kicking
At the work I've had to do,
To keep the men to sticking
When they wanted to get through.

"But I know it's not inspiring
To nurse old machines along,
When everything's conspiring
To make the work go wrong.

"And also please remember,
As about the shop we go,
'Twas the tenth of last December,
Just fifteen years ago,

"When the last new tool was ordered,
And that long before that date
Some of our rigs had bordered,
Very close to out-of-date.

"And tools grow old, the same as men,
And methods alter too,
And what at least could 'get by' then,
Today just will not do.

"I know our work moves very slow,
And our costs are rather high,
But this you've simply got to know,
We all most surely try.

"And if you really mean to say
That you will do your part
To make things right and make them pay,
This is the time to start.

"Let's junk these two old lathes you see,
And buy some I've in mind,
A boring mill and drill will be
A start of the right kind.

"We can't achieve it all to-day,
It's dragged too far along,
And it would break us should we start
To buying now, too strong.

"But let me spend a little
Each month on new machines,
And every jot and tittle
Will return in greater means.

"And every month I'll promise
To make a better show,
In quality and service;
If not, I'll gladly go.

"For competition's very stiff,
And when one falls behind,
The other fellow's winning if
He's up to date, you'll find.

"For ancient tools and latest ways
In business do not mix,
And only modern tooling pays
In nineteen twenty-six."

Modern Grinding Operations at the Otis Plant

By Frank W. Curtis
Western Editor, *American Machinist*

Machines used for grinding large work—Fixture for grinding stator frames — Grinding potential switch parts — Grinding and inspecting worms

ONE of the larger shops that has investigated the possibilities of the grinding machine is that of the Otis Elevator Company, Yonkers, N. Y. At this plant a careful study has been made to determine the class of work suitable for grinding and the advantages that can be derived by the application of this type of machine for finishing purposes. The type of work, the nature of the cut, the material to be ground, the time per piece, the finish produced and the operating cost of the machine are the factors that govern the possibilities of employing grinding methods with economy.

The operations illustrated show the methods of grinding elevator parts that are similar in nature to the general class of grinding work. In Fig. 1 is shown a large cast-iron bedplate being ground on a Blanchard surface grinder. The work measures 40x60 in. in surface and is ground on both sides to a thickness of 6½ in., necessitating the removal of approximately ⅞ in. of material on each side. The bedplate is held on an 84-in. magnetic chuck that revolves at 12 r.p.m. The speed of the chuck can be varied from 8 to 20 r.p.m., according to the nature of the work being ground. A 42-in segmental abrasive wheel, connected directly to a 60-hp. motor, is used. The wheel comprises 18 segments having 7½ in. of cutting life. Both sides of the work are ground in an average time of 1 hour, floor to floor time. The former method required 2 hr. and 40 min. The bedplates are made in a variety of sizes, and are ground on the machine illustrated, with the exception of the two largest sizes, which cannot be accommodated within the range of the magnetic table.

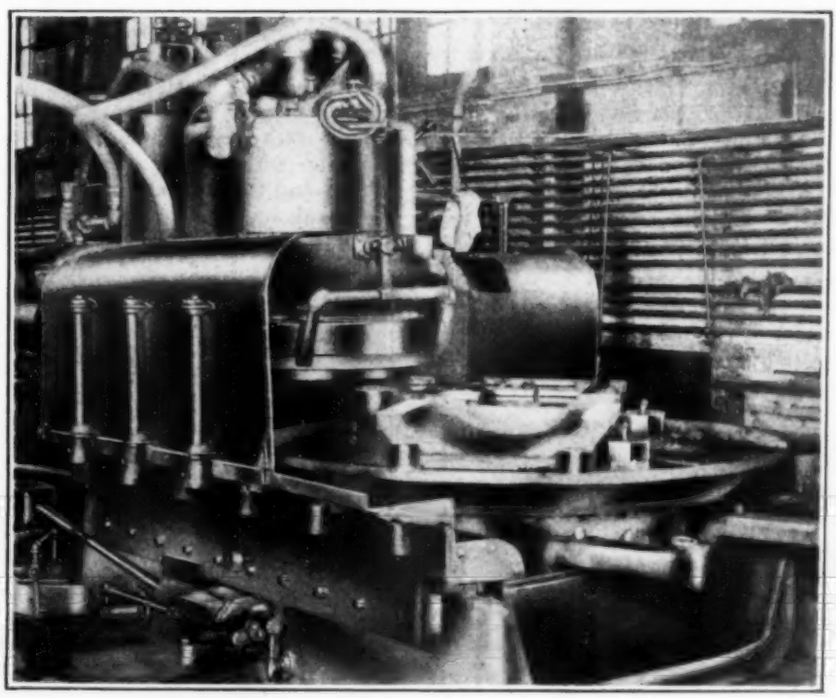


Fig. 1—Blanchard grinder used for surfacing bedplates

In Fig. 2 is shown the same machine being used for grinding a smaller unit. The work, motor clamp-rings, is arranged on the table so that 20 pieces are ground at one setting. The side shown facing the wheel in the illustration is ground first, after which the work is turned over and held by the finished surface for the grinding of the solid side. The time for a set is 35 min., floor to floor time. The former method employed turning, also requiring two settings. Due to the nature of the cut, it was necessary to turn the intermittent side at a slow speed in order to insure a square surface. The grinding operation, however, makes possible a more uniform product in addition to a considerable saving of time.

Another type of grinding machine that is used for a variety of work is the Diamond grinder, shown in Fig. 3. The work *A* is a stator frame set up on the table of the machine for the grinding of the feet. This type of work is produced in many sizes, all of which are ground on the machine illustrated. The grinding wheel is made up of 12 abrasive segments, having 6 in. of cutting body. On continuous operation a set of segments can be run for fifteen weeks before being scrapped. A 40-hp. motor is used for operating the machine. The work table is 80 in. in length and is operated at 25 ft. per minute. The stator frame shown, requiring the removal of ½ in. of material, is ground to size in 10 minutes.

Fig. 2—Grinding smaller work on the same machine

Details of the fixture used are shown in Fig. 4. The work *A* is located on three pins *B* to form a three-point bearing, thereby compensating for the irregularity of the casting. Two locating points *C* are used to form an approximate location. The setscrew *D* then is used to clamp the work against the two end-locating pins *C*. Two setscrews *G* are tightened against the work to avoid end play, while two clamps *H* are used for holding the work in place. The fixture is simple in construction, yet is practical for locating the work properly for grinding. In order to determine whether the proper amount of material has been ground off the feet before the work is removed from the fixture, the gage shown at *K* is used for checking the ground face from the core opening. The gage is made of two hardened and ground locating blocks connected by two ⅜-in. bars. It is necessary to use the gage when setting up the machine so that the graduations may be noted, after which the gage is used only for every tenth piece. In handling this class of work on a grinding machine, it was found necessary to make slight changes in the pattern of the casting, so that the amount of material to be removed by grinding was reduced.

Grinding Grids

The Springfield grinder, Fig. 5, is shown set up for the grinding of four sets of grids. It is necessary to provide the three lugs of each grid with flat surfaces to form good contact when assembled and, for this reason, the method shown has been adopted. Due to the springing nature of the work, it was necessary to locate V-blocks on the magnetic chuck. These blocks, together with the magnetic current, hold the work securely while the surfaces are being ground. Four sets of grids are ground in 4 min., floor to floor time.

On the same machine is ground a variety of work such as shown in Fig. 6. At *A* is shown a cast-iron case that is to be ground on the surface shown at *B*. The work is ground, one piece at a time, being held in place by the magnetic chuck, and the average time for the grinding operation is 6 min. At *C* is shown a similar piece, that of a cast-iron cover which is ground on the surface shown at *D*. This part, also handled individually, requires 2½ min., floor to floor, for grinding. At *E* is shown a brush stem made of cast brass. There are four styles of these stems, all approximately of the same size, and requiring a fixture for holding, which is shown in the next illustration. At *G* is shown a small semi-steel gear that is ground on both sides, arranged on the chuck so that 20 pieces are held in one setting. The average rate for the grinding of both sides is 40 pieces per hour.

Details of the fixture used for grinding the surface of the brush stems are shown in Fig. 7. The fixture comprises an angle-iron casting, 60 in. in length, that is clamped directly to the table of the machine in place of the magnetic chuck. The upper face of the casting is provided with nine sets of Vs, cut with angular sides of 30 deg. At *A*, *B*, *C* and *D* are shown the four classes of work handled on this fixture, and the respective V-slot into which the projecting shank of the work is located. At *E* is shown the clamp used for holding the work in position. The

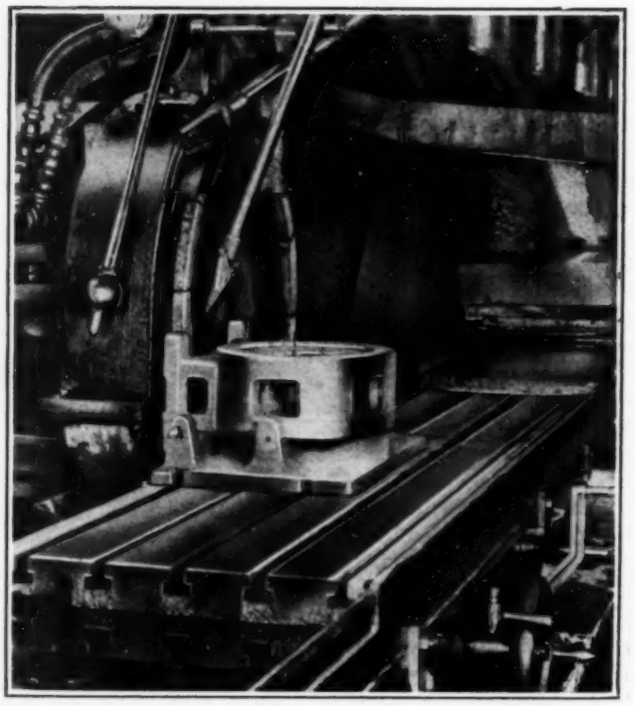


Fig. 3—Grinding stator frames on a Diamond grinder

amount of material to be removed is approximately ☆ in., and the total time required for grinding the nine pieces is 15 min., floor to floor.

Grinding Magnet Cores

The method of grinding the top face of the magnet cores that are assembled to the contact arm and magnet frame is shown in Fig. 8. These units are ground in pairs so they match when assembled in the final unit. An Abrasive grinding machine is used, equipped with a fixture shown in detail in Fig. 9. At *A* and *B* are shown the parts to be ground. The magnet cores consist of 34 laminations made of 0.0156-in. sheet steel. As there are slight irregularities in the punching of the laminations, it was found necessary to grind the top face in order to produce a smooth finish. The left-hand side of the fixture is arranged to hold the magnet frame which rests on the hardened locating pin *C* directly under the surface of the work to be ground. The plug *D* is placed through the hardened bushings in the fixture and into the 0.3145-in. hole in the work, thus locating the work in correct alignment. A swinging clamp *E* then is brought over the work and locked by the swinging C-strap at *G*. In the center of the clamp is located a spring plunger *H* that bears against the work to hold it in place. As the amount of material to be removed is approximately 0.01 in., of which only 0.001 in. is taken off with each pass of the wheel, the spring pressure is sufficient to hold the work securely.

The locating and clamping arrangement of the contact arm at the right-hand side of the fixture is similar in construction, having the locating pin *K* and the plug *L*, as shown, for aligning the work. Details of the clamping arrangement for another part of similar construction are shown at *M* in which case it is necessary to add another locating block *N*. A dial indicator *O*, mounted on the swinging arm *P* is used to check the size of the finished work. The indicator is swung out of the way when the grinding is being done. A 4½-in. abrasive cup wheel is oscillated over the work until the correct size is obtained. The operation is completed in 8 min., floor to floor time.

In the driving unit of an elevator, there is required

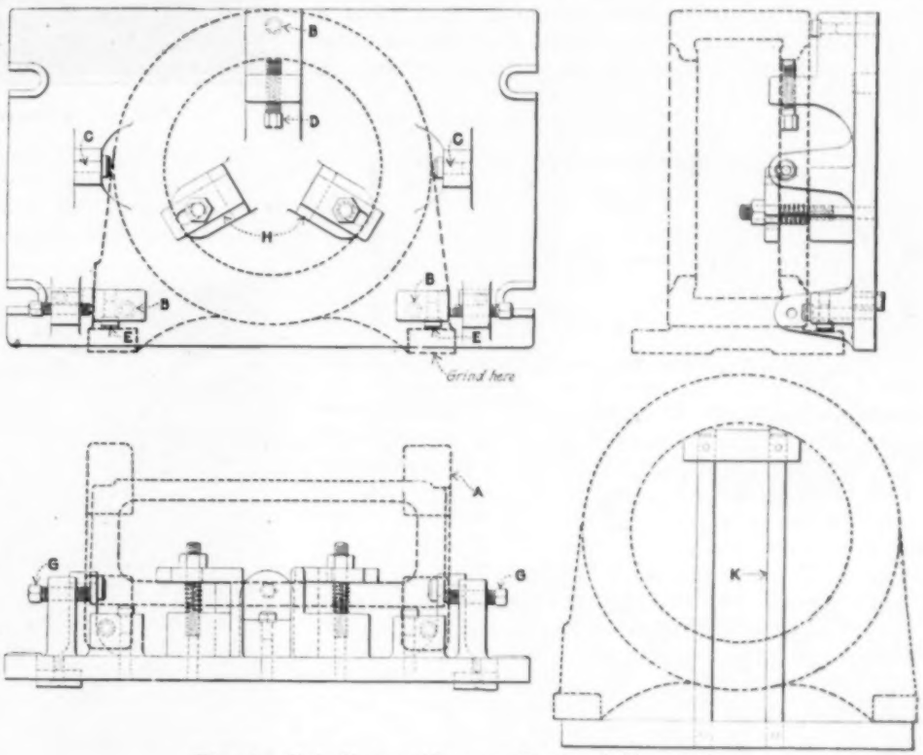


Fig. 5—Grinding grids on a Springfield grinder

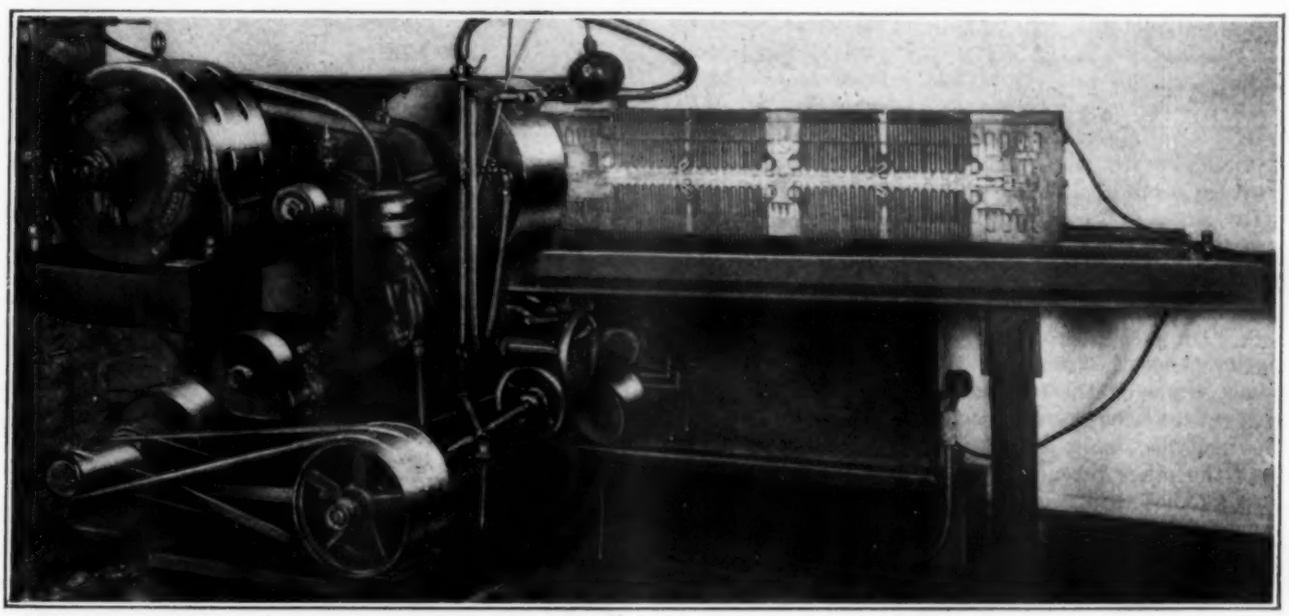


Fig. 4—Details of grinding fixture for stator frame

a worm and wormwheel, varying in size according to the elevator capacity. The company has found that a ground worm not only insures greater accuracy, but also affords a better drive. All the worms, therefore, are ground on a special Brown & Sharpe grinding machine as shown in Fig. 10. Details of the wormshaft, that is located on the machine, are shown in Fig. 11. The worm is quadruple, of 1½-in. pitch and 5-in. lead.

Referring now to Fig. 10, the wormshaft *A* may be seen set on its own bearings in the grinding machine rather than centers, this being done to insure accuracy. The machine is set to the correct lead through gearing after which the wheel *B* is brought to the angular face of the worm in the starting position. The wheel is 7 in. in diameter and ¾ in. in width, and is trued to the desired angle by a fixed device. There is 0.008 in.

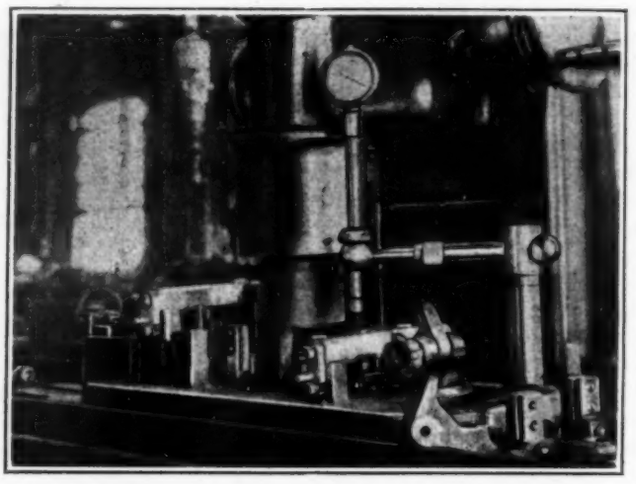


Fig. 8—Grinding a pair of contacts

The worms are inspected for lead and angle on a Reed-Prentice lathe that has been arranged to maintain a carriage travel and feed to correspond to the variety of worms produced. In Fig. 12 may be seen

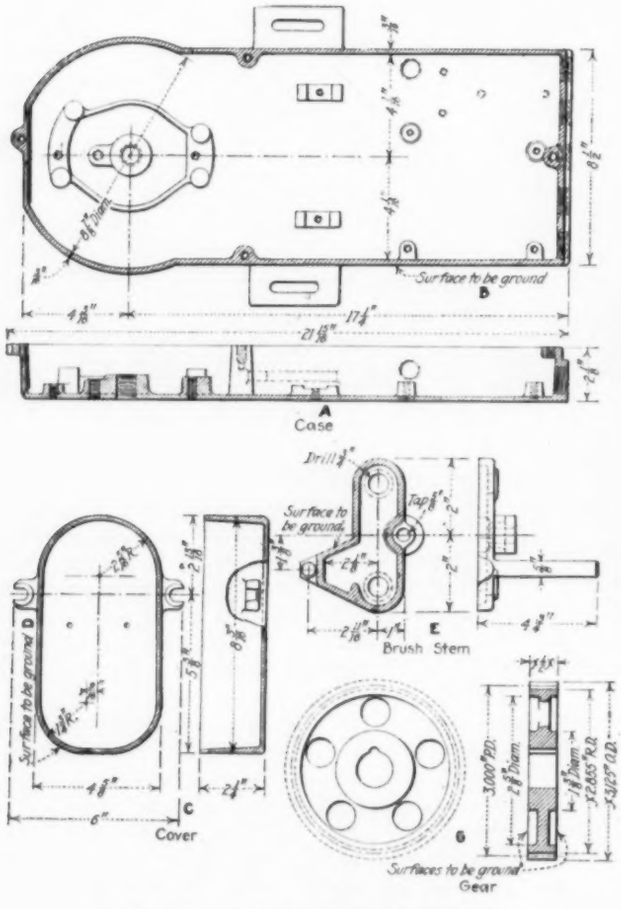


Fig. 6—Variety of work handled

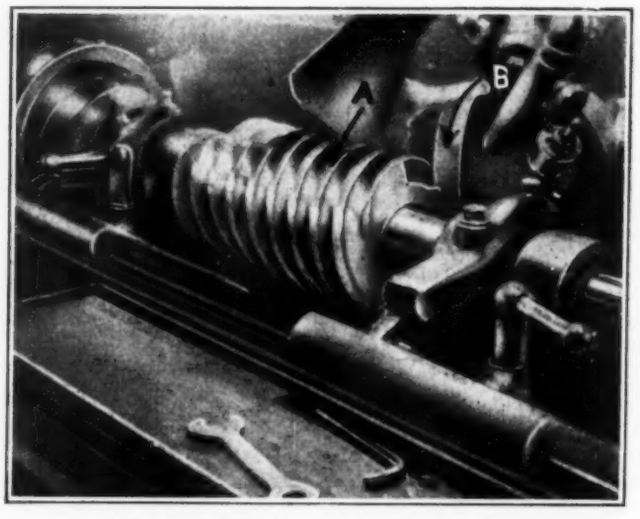


Fig. 10—Grinding a quadruple worm

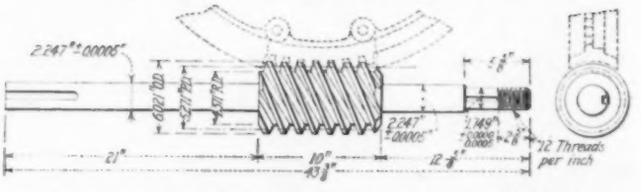


Fig. 11—Details of worm requiring grinding

of material removed, of which 0.004 in. is taken from each face of the tooth. On each pass of the wheel, except the last, 0.0005 in. is removed, while on the last stroke a final cut of 0.00025 in. is taken. The machine then is indexed to grind the other threads. The machine handles worms up to 9 in. in diameter and 29 in. in length, with single, double or quadruple threads. The work is revolved at 20 r.p.m., while for smaller worms the speed may be increased up to 40 r.p.m.

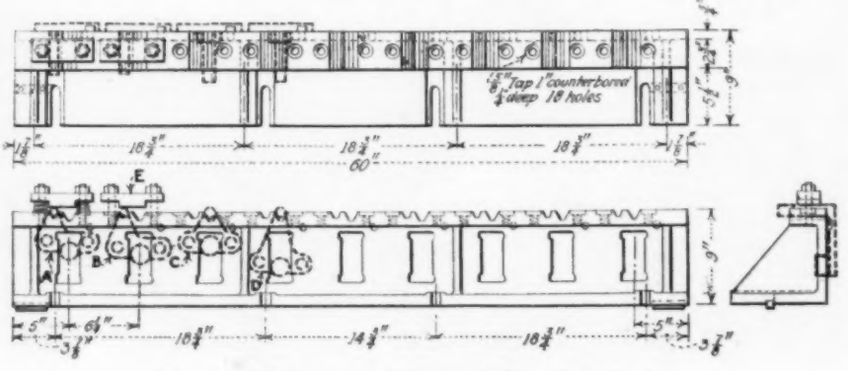


Fig. 7—Fixture used for grinding brush stem

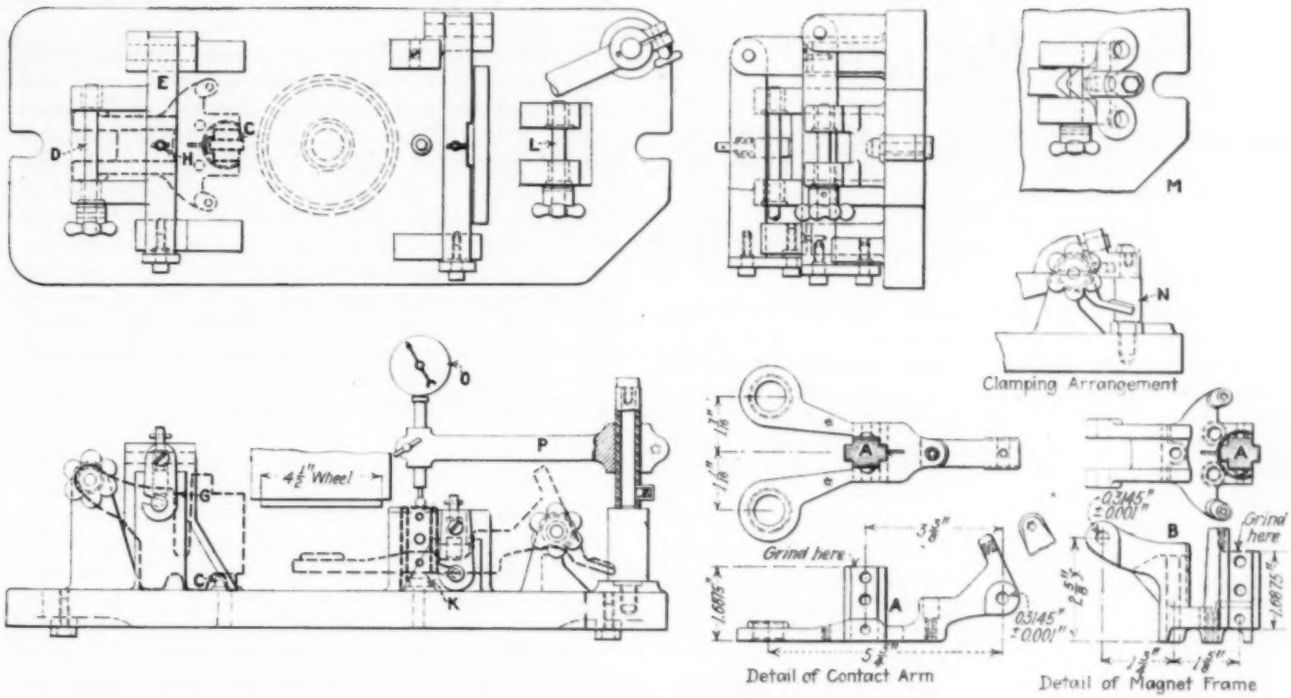


Fig. 9—Details of grinding fixture used

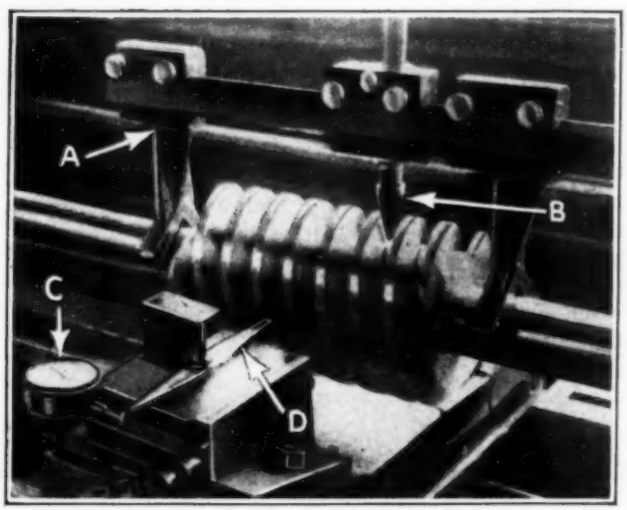


Fig. 12—Inspecting ground worms

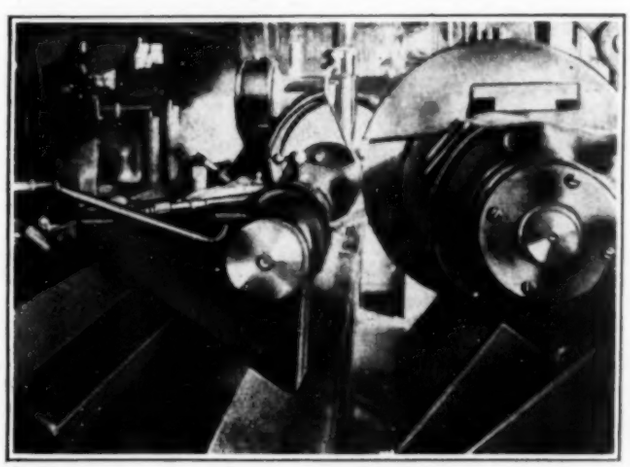


Fig. 13—Grinding the various diameters of worms

the same worm shown in Fig. 11 set up for inspection. The gage *A*, fitting on the shaft bearings with adjustable V-blocks, is provided with an angular gage block *B*. The block is positioned against the face of the worm, instantly showing by sight whether or not the angle is correct. The gage block is also made adjustable to accommodate the various sized worms. To check the leads with one another, the indicator *C*, operating in connection with an arm *D*, that bears against the angular face of the work, is used. The carriage of the lathe is operated so the reading is taken over the length of the worm. A limit of ±0.00075 in. is permitted on the length of each thread. After one thread has been tested the carriage is moved to the next, being located by means of a micrometer attachment.

All worms are ground on the outside diameter as shown in Fig. 13. The worm in the illustration is the same size as shown in Fig. 11, and the machine is a Cincinnati grinder. The work is run through in lots of 25. The bearings are ground first, after which the work is rehandled for grinding the outside diameter. The average total grinding time is 15 min. per piece, floor to floor. The operation is an example of the advantages of modern grinding equipment, inasmuch as the time required for grinding the same part on one of the older types of machines was 30 minutes.

The engineer's definition of waste is that loss due to the difference between the best practice and that of the average. The idealist, however, calls everything waste that is less than the theoretical maximum.

Something not to be lost sight of is the possibility of reducing the investment in materials in process. It is easily conceivable that, due to a reduction of time between the condition of raw material and the condition of finished product, an investment in equipment might be very desirable, even though the equipment was to be idle half the time.

Book Reviews

Tool Engineering—Punches, Dies and Gages. By Albert A. Dowd and Frank W. Curtis. Three hundred thirty-three pages, 6x9 in., blue cloth boards, 171 illustrations. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York City. Price $3.50.

Punches, Dies and Gages is the third of the Dowd and Curtis series on tool engineering. The first book dealt with jigs and fixtures. The second book dealt with fixtures for turning, boring and grinding. A great part of the material for all three books was published first as a series of articles in the *American Machinist* and proved to be one of the best approved and most appreciated series ever published.

In the third book the subjects treated are forging dies, punch press dies, gages for interchangeable manufacture, modern drafting room practice, elementary pattern work (as it affects the tool engineer), feeds, speeds, and cutting lubricants. More than 150 pages are devoted to the subject of die design alone.

The authors have delt with fundamental principles, showing as examples, however, illustrations of many dies and gages in actual use. Both men have drawn upon information gained from extensive experience in design and production work and have produced a book that is worthy of the attention of all tool engineers and students of tool engineering.

Annual Report of the Board of Regents of the Smithsonian Institution, 1924. Five hundred twenty-two pages, 6x9 in., cloth board covers. Published by the Government Printing Office, Washington, D. C.

The report shows the operations, expenditures, and conditions of the institution for the year ending June 30, 1924. There are two appendices, one consisting of articles of scientific character, and the other of reports on the national museum, national gallery of art, Freer gallery of art, bureau of American ethnology, international exchanges, national zoölogical park, astrophysical observatory, international catalog of scientific literature, library, publications.

Mass Production Equipment. By Philip Gates. Two hundred twelve pages, 3x7 in., cloth bound. Illustrated. Published by Crosby Lockwood and Son, London, England. Price 8s. 6d. net.

The secondary title of this book, which is the latest in the series of Lockwood's technical manuals, is "Jigs, Tools and Fixtures, Their Drawing and Design." It indicates more clearly than the cover title the nature of the contents. The book is written entirely from the point of view of the designer of these appurtenances of quantity and interchangeable production rather than the user, but its simple presentation also fits it for the use of the shopman who is ambitious of advancing himself into design work.

The style of presentation is largely suggestive in that, instead of pointing out the multitude of forms that jigs and fixtures take for each particular class of work, the author indicates the major principles relating to each general operation and illustrates them by a few apt examples; the application to particular cases is left to the ingenuity of the designer, which is the keynote of the book.

Drill jigs, milling fixtures, chucks and turning equipment, cutters, taps and dies, gages, press tools, and magnetic and pneumatic gripping devices are discussed in turn. One chapter also takes up in considerable detail the layout of the tool and index control cams for a B. & S. automatic turret lathe. The routine of the drawing room is outlined, and some valuable hints on the proper checking of this class of drawings are given. Many tool and machine data tables are supplied, which, although poorly executed, are in the main quite useful. Both the author and the publishers are English, but much of the information is from American practice; the tables, in particular, refer almost entirely to machines manufactured in this country.

Industrial Safety. A symposium published in the January, 1926, Annals of the American Academy of Political and Social Science, Philadelphia, Pa.

There are 224 pages, divided into seven parts on the Need for Safety in Industry; Organized Accident-Prevention Movements; Safety Code Development and Enforcement; Safety in Specific Industries; Accident Prevention for Certain Hazards; Educating the Worker in Safety and the Relation of Safety Compensation and Rehabilitation.

Under each heading are several papers by men who are well known in industrial work, such as William Green, President, American Federation of Labor; W. H. Cameron, Managing Director, National Safety Council; P. G. Agnew, Secretary, American Engineering Standards Committee; Charles G. Close, Safety Manager, U. S. Steel Corporation; W. Irving Clark, M.D., Norton Co.; M. E. Danford, Works Manager, American Rolling Mills Co.; and John B. Andrews, Secretary, American Association of Labor Legislation. These papers are full of meat and contain many helpful suggestions for managers of all kinds of plants, regardless of size. This issue should be in every shop manager's library for reference.

The Problems of Economic Restoration Developed by the World War. Brought forward at the third general conference of the International Chamber of Commerce, held at Brussels, June, 1925. Sixty pages, 9x6 in. Published by the Commerce and Marine Commission of the American Bankers Association. This book contains the address made by Fred I. Kent as chairman of the special committee to represent the association at the conference, the report of the Economic Restoration Committee and the resolution adopted on this subject. The subjects of reparations, debts, credits, exchange and trade conditions are discussed.

The Human Factor. Published quarterly by the Massachusetts Society for Mental Hygiene, 5 Jay St., Boston, Mass. Price 20c. per copy. This periodical aims to present in digest form the best that is being done in personnel work in business and in industry. It is intended to cull the sound and practical literature on employment procedure, the selection of workers, financial incentives, industrial accidents, the workmen's compensation, mutual benefit plans and the health and welfare of workers.

Making Engraved Rolls of Steel and Copper

Copper cylinders for textile printing machines—How the cylinders are prepared—Two methods employed to transfer the design—Engraving with the pantograph machine

THE copper rolls used on machines for printing textiles are hollow cylinders ranging from 14 to 54 in. in circumference, from 20 to 60 in. long, and of wall thickness varying from ⅛ in. to 1½ in. or more. The thickness of wall has, however, little to do with the utility of the cylinder so long as the latter is sufficiently strong to withstand any pressure that is likely to be brought to bear upon it, but as these cylinders are redressed and re-engraved as they wear, or as patterns go out of fashion, the thicker the original wall the more redressings the cylinder will stand before it becomes scrap copper.

As the cylinders pass from one machine to another in the progress of the work of engraving them they are mounted upon self-centering, expanding mandrels that are often a part of the particular machine in which the cylinder is at the moment undergoing treatment. When the job of engraving is completed and the cylinder is ready to go into the printing machine, a solid mandrel is forced into it by hydraulic pressure and remains a part of the printing roll until the shell is again dismounted for redressing.

The operation shown in Fig. 10 is that of turning a cylinder to size, preparatory to engraving a new design upon it. The work is done in a standard engine lathe, but instead of swinging upon centers, the mandrel, which is one of the self-centering and expanding type, runs upon its own journals in bearings that are provided with swinging caps to facilitate handling the work into and out of the lathe. The writer could find no reason for the preference for this method except that it "had always been done that way." It would seem to a machine-shop man that a good pair of centers would not only be much more convenient, but more conducive to accurate work as well.

"Diameter" is a term almost unknown in the engraving shop. Except for the diemaker, who, after due mathematical calculation, measures the diameter of his dies with an ordinary micrometer, nobody pays any attention to this most convenient dimension. A 14- or a 20-in. roll in an engraving shop is always 14 or 20 in. in *circumference*—which is, after all, the logical dimension for an engraver to use, for it is the one that compares directly with the size of his patterns.

Instead of the familiar firm-joint caliper and rule that would be the constant companions of a mechanic engaged in similar work, all the operatives in an engraving shop who are concerned with the sizes of round pieces carry across their shoulders a graduated steel tape. When a measurement is to be taken, an expert movement of the hand flips the tape around the cylinder, the free end is caught by the disengaged hand and the tape is drawn taut, with the edges matching. The circumference may then be read directly from the marks of the tape. If the operator is "setting-in" for a size he does not find it necessary to stop his lathe.

The surface of the copper cylinder must be very smooth and without lines or scratches of any kind, for even a very faint scratch would be capable of picking up some of the color in the printing machine and would leave a corresponding blemish upon the goods. The next step after turning them is to polish the cylinders,

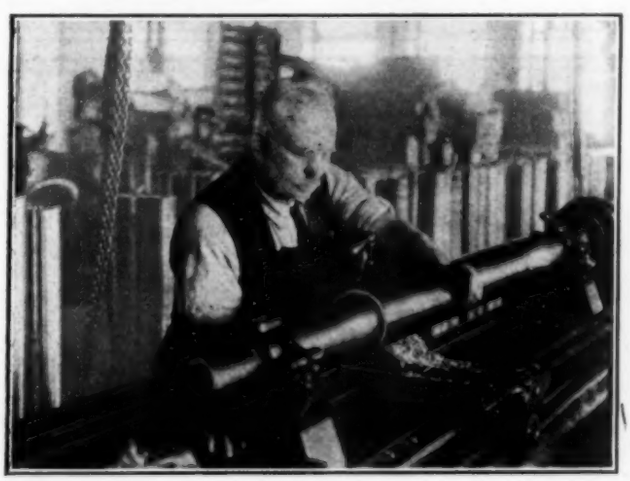


Fig. 10—Turning and measuring a copper cylinder

Fig. 11—The polishing operation

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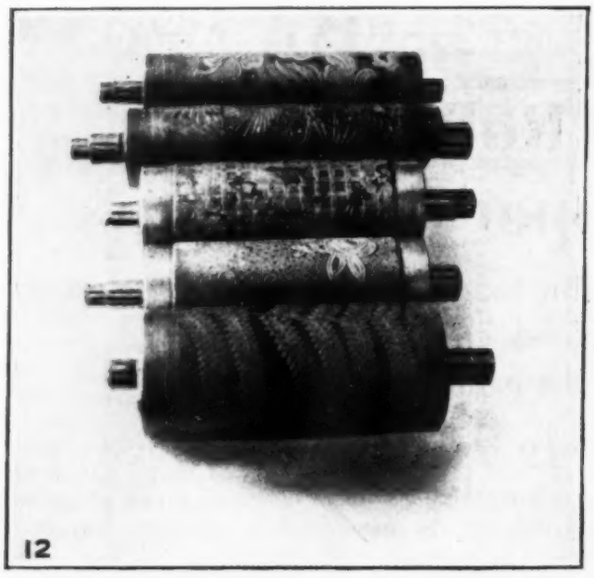
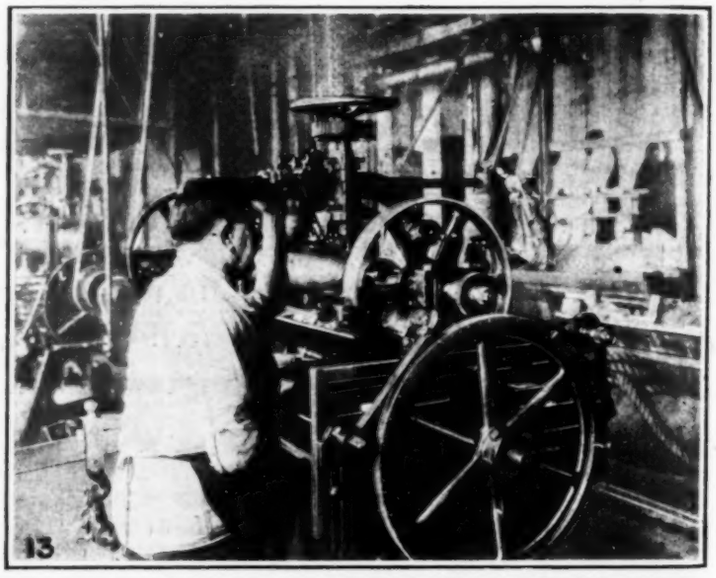




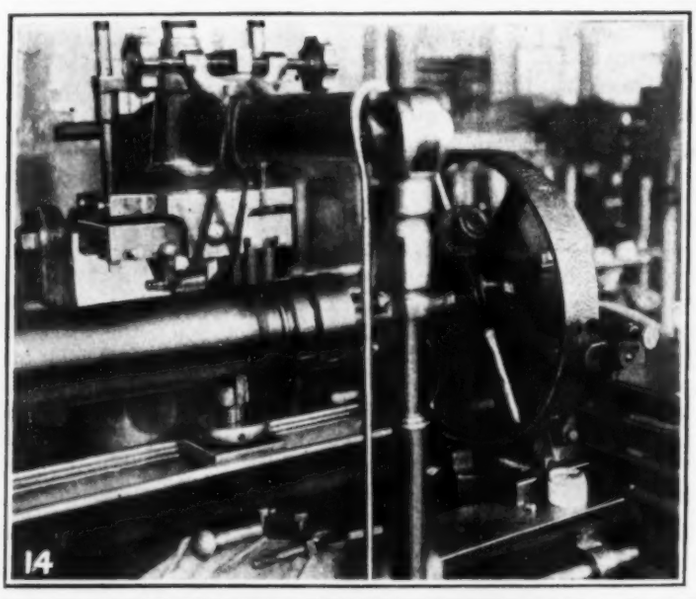


Fig. 12—Some of the "mills" used to transfer the design. Fig. 13—"Milling" the design on a copper cylinder. Fig. 14—A detail of the milling machine. Fig. 15—Engraving the zinc plate. Fig. 16—Design engraved on zinc plate. Fig. 17—Putting on the protective coating

which is a hand operation, carried out as shown in Fig. 11 by rubbing the surface of the revolving cylinder with the abrasive agent. The abrasive is the same kind of Scotch sandstone that is used in the grinding machine described in the first part of the article, and is purchased in the form of rectangular slabs, convenient for the purpose.

The polishing machine shown is an improvised one, consisting mainly of a head that is loosely mounted on the bed so that it can be swiveled, and a long spindle provided with a fixed cone near the main bearing, a cone-shaped bushing to slide on the outer end of the spindle and a nut that is threaded to the spindle. At the outer end the spindle runs in a half-box, open at the top, and the whole outfit is flexible enough so that the operator can lift the spindle out of the half-box and swing the free end toward him far enough to get a cylinder on and off.

Cylinder Is Centered and Driven by Cones

While on the spindle, or mandrel, the cylinder is held between the opposed cones, one of which is fixed and the other backed up by the nut, so that it is centered with a sufficient degree of accuracy for this job and at the same time driven by the friction of the cones.

Between the members of the bed there is a shallow trough of wood, so mounted that by depressing a treadle it may be raised partly to enclose the under side of the cylinder. The trough is filled with water, and during the polishing operation is raised so that the cylinder dips below the surface. After the work is nearly completed, the trough is lowered and the copper is wiped dry and rubbed with soft cloths.

There are two distinct methods by which the design is engraved upon the polished surface of the copper cylinder: One is the so-called "milling" process, described in a previous article in connection with the making of steel rolls to produce designs upon metal. The other is an engraving process conducted in a specially designed machine called the pantograph machine, by means of which an operator is enabled to reproduce a design in multiple by merely tracing once over the pattern.

In the first-mentioned method the sketch maker's copy on celluloid of the original design is transferred by hand engraving to a circular steel die, and from it by a combined process of knurling and etching to the steel mills, of which those shown in Fig. 12 represent typical examples. These mills are then used in the machine shown by Figs. 13 and 14 to roll or knurl their embossed designs into the soft metal of the copper cylinder. This latter stage is wholly mechanical and does not involve the etching process.

Though quite different in appearance, the engraver's "milling" machine has much in common with the screw-cutting engine lathe. It is provided with a carriage, and with a master-screw and change gears to traverse the carriage along the bed at any predetermined relative rate of advance. The tool holder—which is at the top of the machine—swivels in both planes like a compound rest. In addition the machine has indexing features, which may be applied either to the main driving spindle or through the master-screw to the carriage.

The tool is one of the "mills" that we have here described and illustrated. In this particular case it happens to be a very small one, but any of those shown in Fig. 4 of the previous article or Fig. 12 of this article may be used. Pressure is applied to the mill by the weighted compound levers extending toward the front of the machine, and may be augmented by the operator's hand if he deems it necessary. A secondary lever at his left raises and sustains the weights whenever the operator wishes to adjust the mill or to remove it from its holder.

The appearance of the handwheel, gear and screws at the top of the machine would seem to indicate the possibility of applying screw pressure, but this is not the case. The screws and handwheel are there only for the purpose of actuating the swivels, tilting the mills to bear evenly across their width of face, or turning them about a vertical axis to advance in conjunction with the carriage when the latter is geared through its master-screw to lay on the pattern in the form of a helix.

By means of this machine any pattern for which a mill has been made may be transferred to the copper quickly and accurately. The circumference of the cylinder must, of course, be calculated very closely to contain that of the mill; otherwise there would be an overlap at each revolution and the copper would carry only a jumble of lines instead of the pattern. It is necessary before applying power to the machine to step it around by hand through a complete revolution with the mill bearing very lightly upon the work in order to make sure that there is no overlap.

As many patterns remain in vogue long enough to involve renewal, sometimes many renewals, of the cylinder, the milling method is the most economical in the long run, as the work is two-thirds completed when the mill is finished. The latter thus represent so much "velvet" on the next or succeeding jobs.

By the alternative method, involving the pantograph machine, though the first cylinder may be produced much more quickly, there is little salvage in case a renewal is wanted, and the second cylinder is likely to cost about the same as the first one. Nor does the latter method insure the absolute duplication that is a feature of the milling process.

Pantograph Method Requires Enlarged Copy of Pattern Instead of a Reduced One

It will be remembered that practically the first step in the production of an engraved roll or cylinder by the milling method is to make a reduced copy of the original design to the exact size it is to appear upon the finished goods, whether metal, cloth, leather or paper. To prepare for the alternative method, in which the pantograph machine is used, the sketch maker reverses his tactics and makes an *enlarged* copy of the design, two, three, or even ten times the original size. He still uses the projectiscope, but instead of a strip of celluloid his drawing material is a plate of zinc.

The zinc plate, with the pencil tracing of the design upon it, is taken in hand by the engraver, Fig. 15, who, with his graving tools, sinks the lines into the metal. If the design is a large figure his copy will contain exactly one section, or unit, between the lengthwise and widthwise points where the design begins to repeat itself upon the goods. Smaller figures may, for the sake of convenience and expeditiousness, contain several such sections. A portion of one of the zinc plates may be seen in Fig. 16 as it lies upon the table of the pantograph machine, with the stylus resting in one of the lines of the copy.

The pantograph machine is, as its name implies, a

machine involving the principle of the pantograph to reproduce upon a given surface the movements of a stylus in the hands of an operator. The movement of the stylus may be reduced, or it may be amplified to any extent within the range of the machine, preserving meticulously the proportions of the copy. Also the pattern may be duplicated as many times as there are tracing points on the machine, which number depends, of course, upon the relative sizes of pattern and machine. On the job shown by Fig. 17 there are seventeen points, each duplicating the copy traced by the stylus and, conjointly, covering the length of the cylinder.

The stylus of the machine may be seen at *A* in this illustration, and the prepared cylinder (in this case nearly finished) at *B*, with the marking points *C* above it. The marking points are sharp-pointed diamonds. The mechanism is such that any movement of the stylus sidewise brings about a proportionate sidewise movement of the diamond carrier, while any movement to and from the operator causes a partial rotative movement, still in the same proportion, of the copper cylinder.

When the operator has traced the pattern once with the stylus he has seventeen copies on the cylinder, covering its length. He then indexes the cylinder forward without disturbing any other adjustment and repeats the operation. The number of repetitions necessary to complete the cylinder depends upon the height of the pattern with relation to the circumference of the cylinder.

With the milling process, heretofore described, the circumference of the mill must bear a definite and exact relation to that of the cylinder. The latter must contain the former a certain number of times without remainder—else the job is all off. With the pantograph process the relation between the dimensions of the pattern and those of the cylinder is not so arbitrary, as the exact division of the one into the other (which is just as necessary) may be accomplished by a few minutes of calculation and corresponding adjustment of the machine.

Though we have spoken of the pantograph machine as "engraving" the copper cylinders, the diamond marking points of that machine do not actually cut the lines of the pattern into the metal. They cut only through a protective coating of wax and expose certain parts of the metal (the lines) to the action of the acid of an etching bath—the acid is the real cutting agent.

In Fig. 18 may be seen one of the copper cylinders, still in the machine—Fig. 11—in which it was polished, receiving its protective coating of wax from a printer's roller, manipulated by the operator. The roller distributes an even coating of the wax over the surface of the cylinder, which is then removed from the arbor and subjected to a mild degree of heat to get the coating. The cylinder is now ready for the pantograph machine.

The reader need not be reminded that textiles and wall papers appear in many-colored designs, and he may reasonably inquire how all these colors are laid on with one cylinder. The answer is quite simple—they are not. Printing machines may carry as many as twelve cylinders, each cylinder depositing its basic color upon the material passing through the machine.

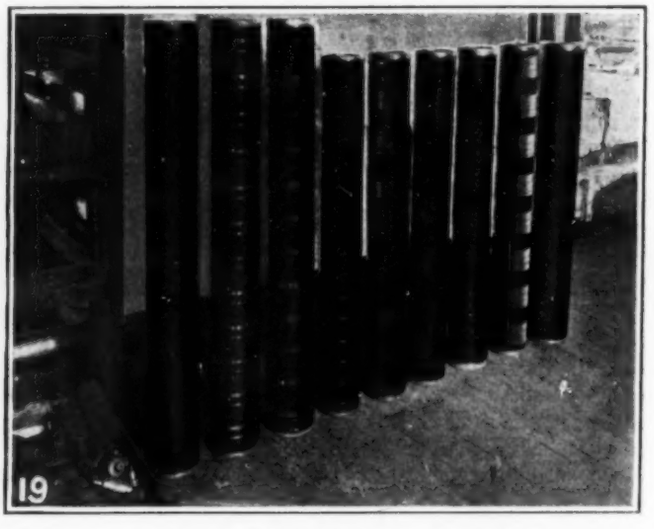


Fig. 18—The pantograph machine. Fig. 19—Two sets of printing cylinders ready to be etched

For every primary color of the design there must be a separate cylinder. Some of the secondary colors and shades may be produced by a judicious overlapping of the designs on different cylinders and by "half-etching," so that the number of colors on a certain piece of goods is an uncertain index—except to the initiated—of the number of cylinders needed to produce it.

A given design may carry—let us say—ten colors, and may require six cylinders to lay them on. Such a set may be seen to the right in Fig. 19, while another set of three, to produce a design of four, or possibly five, colors and shades may be seen at the left. All the cylinders of any one set are marked on the pantograph machine from one pattern and without disturbing the set-up, but of course are handled successively. To find out how this may be done let us go back to Fig. 15, where the zinc plate copy is being engraved.

When the sketch maker copies the original design by tracing upon the zinc plate the shadowy lines thrown upon it by the light from the projectiscope, he traces the whole pattern; and the engraver cuts all of the pencil lines into the metal. The engraved plate and the original design are next taken in hand by a color artist, who proceeds to paint that pattern in all the colors of the original. He also marks upon the zinc, in a convenient corner, the number of cylinders required to print the design and what color each is to represent.

The operator of the pantograph machine prepares to engrave the design by fixing the plate to the table and putting a cylinder in place. He then traces with the stylus all of the lines on the pattern that surround one certain color. When that cylinder is finished he replaces it with another one and, without disturbing any of the adjustments, proceeds to mark those lines surrounding another of the colors. This he repeats until the number of cylinders required to complete the set is obtained.

Now upon several, if not all of the cylinders of a set, there will be portions of the pattern that overlap portions on other cylinders, and where two colors are thus allowed to deposit in the same place on the goods the result will be a secondary color, quite different, perhaps, from either of the primary colors that produced it. To obtain the necessary combinations to bring out the delicate colors and shades it is necessary that some of the lines on some of the cylinders be lighter (or shallower) than others.

A cylinder that is to bear nothing but full lines and colors is taken to the etching room where it is mounted upon a self-centering arbor that turns in bearings just above the acid vat. The vat itself is provided with means of raising and lowering the level of the acid. With the cylinder rotating at a constant and uniform speed, the level of the acid is raised until the lower side of the circumference of the cylinder dips into it.

The acid spreads evenly over the waxed surface, corroding away the metal wherever the diamonds of the pantograph machine have removed the wax to expose it. The corrosive action of the acid is allowed to continue for a certain length of time which experience has specified, when, without for an instant slackening the rotative motion, the cylinder is transferred to a bath of cold water and the acid washed off.

If the cylinder is to bear lighter lines in addition to the full ones, the full lines are traced first on the pantograph machine and the cylinder etched as above described, but the acid is allowed to act for but a fraction of the full period. The cylinder is then taken back to the machine and the half-lines traced, after which it is returned to the etching vat and the full period completed. It is obvious that the lines already half-etched will now be carried to full depth during the second period, while those that were laid on the wax at a later time will reach but half depth. This process is called "half-etching."

The cylinders are now cleaned of the wax coating and sent to the inspection bench for final observation. The inspector examines the entire surface under a glass, compares it with the original pattern, takes impressions where necessary to substantiate his judgment, and corrects any error that he may find. When he has finished with them the cylinders are ready for the printing machine.

The next time you keep a salesman waiting, just remember that you have to help pay for his time—yes, even though you don't buy anything from his firm.

In plants operating on definite control systems, as all plants should be operated, every visitor should obtain access through the front door, and his interview should be arranged according to routine. No reason to delay him, of course. However, it is important to know who arrives, where he goes and when he leaves, in the visitor's interest as well as in that of the plant.

Seen and Heard

By John R. Godfrey

Ball and roller bearings in machine shops and machine tools

Ever since the ball bearing came into the lime light in the high-wheel bicycle days of the eighties, it has been seeking new fields to conquer—and it has conquered a lot of them. It wasn't long before ball and roller bearings were striving for the same fields, and the strife still continues in bearing circles.

Line shafts and countershafts were among the first targets for the promoters of both ball and roller bearings. It was easy for either to show a saving in power. And not all of the saving was due to the bearings in many cases.

The first thing the ball or roller bearing man did was to line up the shaft before he applied his new bearings, and then he modestly claimed all the saving for the bearing. It reminds me of a friend who sold line-shaft leveling devices. If he failed to get a cordial hearing he made the boss mad by betting him that his line shaft was out of line. He was safe enough in ninety-nine cases out of a hundred and the demonstration of proving it frequently sold one of the leveling machines.

Both ball and roller bearings have gone way beyond the line-shaft stage. They are accepted as standard for most large plants where line shafts are used. The tendency has been toward individual motor drives but there seems to be a swing back toward group driving in some quarters. In any case, we shall always have shaft bearings of some sort as a market for bearings.

Ball and roller bearings have made a great killing in the automobile field, as well as in many others. But outside of countershafts, the machine-tool designer has fought shy of ball bearings. Now, however, he is coming to use ball bearings in various parts of machine tools. High-speed grinding spindles for internal work have been fitted with ball bearings for many years, but it wasn't all plain sailing, and for years the plain, hardened bearing held its own. Today it has almost become obsolete.

Drilling spindles for high speeds have also gone to ball bearings almost exclusively. Much of the grief in the early machines was due to the pounding out of the bearings, because of the failure to realize the necessity for balanced spindles.

Ball bearings are much in evidence in the newer milling machines, for all except the spindle bearings, in much the same way as the motor cars use ball or roller bearings everywhere, except for the crankshafts. And even now there are a few notable examples of successful automobile engines with ball-bearing crankshafts.

Machine designers complain that ball bearings are not sufficiently accurate for use on machine tool spindles; that the solid bearing is much more rigid for heavy duty. All of which sounds a bit funny when you hear ball-bearing makers complain that few of the machine tools they buy are sufficiently accurate to make good ball bearings, until after they have taken them down and refitted many of the parts. But both ball and roller bearings are gaining all the time, and are being used to some extent on lathe spindles.

Ideas from Practical Men

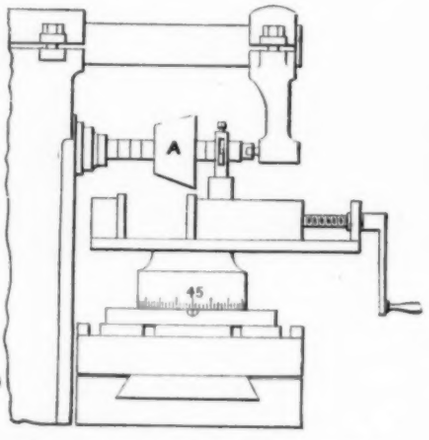
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Angular Turning on a Milling Machine

BY CHARLES KUGLER

The article entitled Ingenuity, by John H. Earl, published on page 662, Vol. 63, of the *American Machinist*, reminded me of a job I saw done by a lathe hand on a milling machine.

The work, shown at *A* in the illustration, was of fiber and had a 1-in. hole through it. The outside was to be turned to an angle of 45 deg. With the work mounted on an arbor, the toolholder was clamped to the movable jaw of the swivel vise belonging to the machine. A $\frac{3}{8}$-in. hole was drilled and tapped in the movable jaw, and a screw, a strap, and a piece of iron for packing, completed the clamping arrangement. The vise was set to the required angle and the feed was accomplished by traversing the movable jaw of the vise by means of the crank handle.



The set-up in the milling machine

Setting the Compound Rest

BY LESTER M. COLE

Most mechanics prefer to have the compound rest of the lathe set at an angle of 30 deg. with the cross-slide, so as to be ready at all times to cut threads by feeding in with the compound rest. In fact, one prominent make of lathe has the T-slot for the toolpost parallel with the ways when the compound rest is at an angle of 30 deg. with the cross-slide.

Often it is necessary to face a piece of work to a decimal size in thickness. Using the carriage-travel wheel to get the required thickness involves a lot of cutting and trying. Moving the slide of the compound rest parallel to the ways means extra work, and sometimes it cannot be done on work that is held on centers.

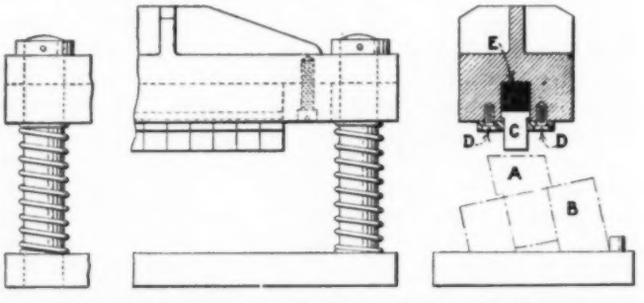
In cases of this kind, I have found the following method very useful. Let the compound rest remain at an angle of 30 deg. with the cross-slide, and move the slide of the rest in twice the amount that is to be faced off. The graduated collar on the screw will indicate how much the slide is moved. The actual longitudinal movement will be proportional to the sine of the angle, and since the sine of 30 deg. is 0.5 or one-half the radius, the amount faced off will be exactly one-half of the amount the slide of the compound rest is moved.

A Pressure-Equalizing Device

BY H. B. SCHELL

Some toolbits, shaped as at *A* in the illustration, were to be ground on the ends in a Blanchard grinding machine, and a number of jigs as at *B* were made to hold them for the operation; several jigs being placed on the table of the grinding machine at one loading.

It was essential that the shoulder of each toolbit, of which each jig held ten, should bear firmly upon the surface of the jig in order that all should be ground to the correct length. The group of ten bits in each jig was held by the pressure of a single setscrew at the end of the row, and much difficulty was experienced in making sure that all of them were properly seated. An attempt to drive down one bit with a lead mallet after the setscrew was tightened was sure to cause others to be lifted out of contact.



A pressure-equalizing device to load grinding jigs

To overcome the difficulty a pressure-equalizing device was made as here shown to force all of the bits to their seats before the setscrew was tightened. The pressure-equalizing medium is rubber. In experimenting with it, we found that a variation in height of the pieces amounting to as much as $\frac{1}{4}$ in. would be taken care of, although this amount of variation did not occur in practice.

The sectional view given herewith shows the construction of the device. Ten movable blocks of metal *C* are held in line by the two strips *DD*, and above them is a strip of soft rubber *E* which is confined sidewise

by a deep slot in the sliding member of the device and endwise by two blocks that are fitted into the slot and held in place by fillister-head screws.

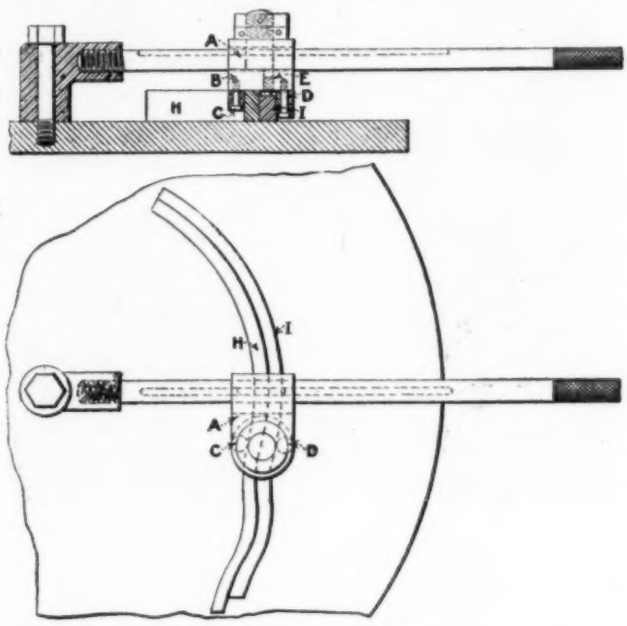
When the loaded jig is placed in the device, the latter set into the arbor press and the sliding member brought down by means of the hand lever, each of the ten movable blocks rests upon a toolbit and forces its shoulder into contact with the jig surface regardless of the variation in length. Holding the bits thus under pressure, the setscrew is tightened and the loaded jig is ready for the grinding machine.

An Inexpensive Bending Tool—Discussion

By J. C. Harper
Greenock, Scotland

On page 323, Vol. 63 of the *American Machinist*, H. L. Wheeler describes a tool for bending pieces of flat stock. In the bending tool described, however, the radius of curvature must of necessity be constant.

The bending tool shown in the illustration was designed for bending pieces of any section within its



Details of bending tool

capacity, to any degree of curvature, where they were required in sufficient quantity to warrant the making of a form of the required shape. It has been found to be admirably suited for producing parts where in any one piece, the radius and direction of curvature may vary considerably. The tool is hand-operated by means of a lever pivoted in the center of the base plate, as shown. The bracket *A* is feather-keyed on the lever and slides thereon, the lever being splined. Part *B* rotates freely in the bracket and carries the rollers *C* and *D*, set diametrically opposite each other. The screw *E* serves to keep the stock being bent in contact with the base plate. *H* is the former, fastened to the base plate.

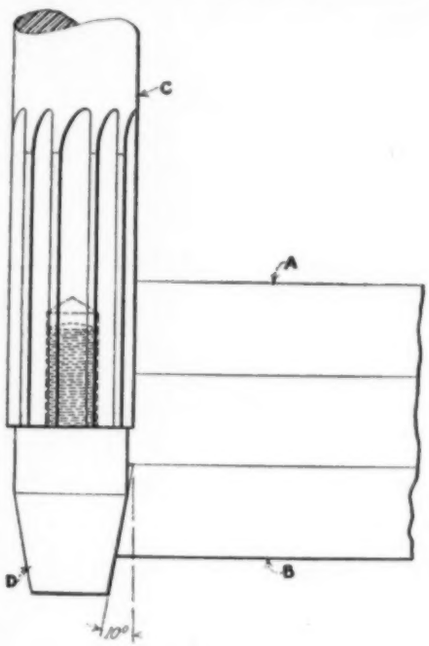
In operation, the stock *I* is entered between the former and the roller *D*, the end being firmly held by suitable means. The lever is then pulled around and, since the inside roller *C* follows the curvature of the former, the stock is forced into the required form by the outer roller *D*.

A Convenient Profiling Fixture—Discussion

By Alfred T. Gregory

I was greatly interested in the ingenious profiling fixture described in an article under the title given above by I. B. Rich, on page 546, Vol. 63, of the *American Machinist*.

There is, however, one feature that could be improved. The illustration shows the work *A* and the hardened steel former *B*. It will be noted that the edge of the former plate is beveled to an angle of 10 deg. The pilot *D* on the end of the cutter *C* is tapered to the same angle as *B*. The lower the cutter *C* is set the less stock will be taken off, and vice versa. This feature permits the operator to set the spindle of the drill press to cut to a certain size and to maintain that size after regrinding the cutter, by adjusting its height. While this may not be necessary for instrument covers and similar pieces, its use on cams and such work that requires considerable accuracy is essential. The angle of 10 deg. is selected arbitrarily and would be altered to suit the requirements of any particular job.



The profiling fixture

The illustration also shows a simple design for the cutter and pilot. They are each made separately. After hardening, the pilot is screwed or driven into the cutter. The cutter and pilot are then ground together thus insuring their concentricity.

A Filing Machine Improvised from a Sensitive Drill Press

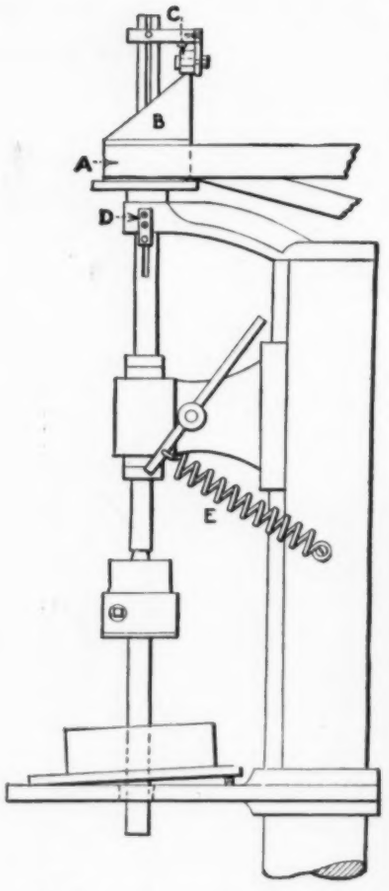
By Charles Kugler

The small shop that has no filing machine need not be without one if there is a small, sensitive drill press available. We rigged up such a machine as shown in the sketch and found that its use soon repaid the small outlay involved in making the changes.

The key in the driving pulley *A* was removed and a cam, *B*, attached by screws to the periphery of the pulley. This cam had about 1¼ in. of throw. A roller, *C*, was made fast to the upper end of the drill-press spindle by means of a suitable bracket.

To prevent the spindle from revolving we screwed the piece *D* to the frame and in the lower end of it

inserted a pin that projected just far enough to enter the keyway in the spindle. The file was held in the regular drill chuck. A light coil spring *E* was attached to the hand feed lever to assist the weight of the parts to keep the roller always in contact with the cam. To impart proper clearance to the die being filed we used a plate of ½-in. cold-rolled steel with a couple of setscrews near one edge as shown, which gave us an adjustable table to secure different angles of clearance on the dies.



Drill press converted to a filing machine

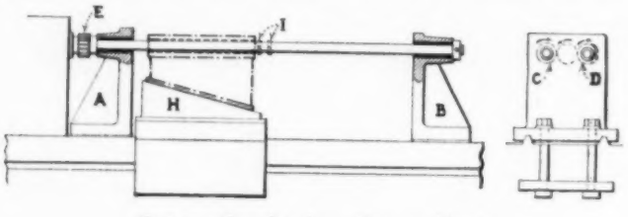
It is evident that as the pulley and its attached cam revolves an up-and-down movement will be imparted to the spindle.

Boring in a Lathe

By B. J. Stern

Sometime ago we took a contract to build some special machines, the main castings of which each had two holes about 3 in. in diameter and 4 ft. in length, and at a steep angle with the base.

Having no horizontal boring machine, we bored the holes in an old 30-in. lathe. The tailstock was removed and two special angle plates *A* and *B*, bushed for two



Set-up for boring the castings

boring bars at the proper distance apart, were mounted as shown in the illustration. Gears *C* and *D* were attached to the headstock end of the boring bars, and were driven by the gear *E*, screwed on the spindle nose. The angular casting *H* was attached to the carriage, and the casting to be bored mounted thereon.

Since the lathe was powerful enough to take the roughing and fininshing cuts at one time, the tools were set so that one followed the other as at *I*.

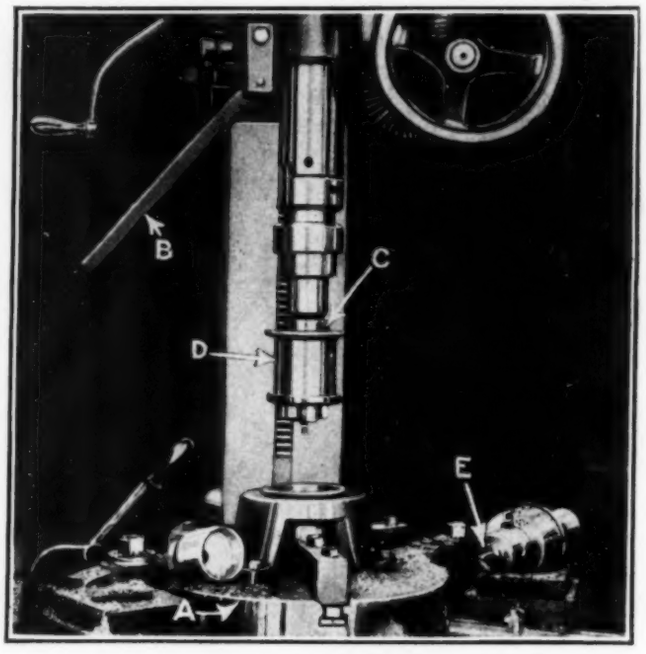
In order to mount and dismount the castings to be bored, the angle plate *B* end had to be removed. With the set-up as shown, the job was put through in a surprisingly short time.

A Collapsible Tap Altered to Give Higher Production

By R. C. Randol

In machining aluminum hub caps, time was a factor and a drill press the only available machine.

A three-jawed chuck was remodeled, as at *A*, to clamp the caps and guide the combined boring and facing tool, *E*. The collapsible tap was altered so as to be expanded



How the tap was used

by bringing the lever *B* into a vertical position and raising the spindle of the drill press until a fiber tip on the end of the lever came in contact with the expanding ring, *C*.

The solid sleeve *D* was substituted for the studs and rods that carried the tripping ring. This change allowed the tap to be grasped while in motion, and by aid of Magic chucks, all tool changes were made with the machine in continuous motion. Distillate was used for a cutting fluid.

Drilling Spring Steel

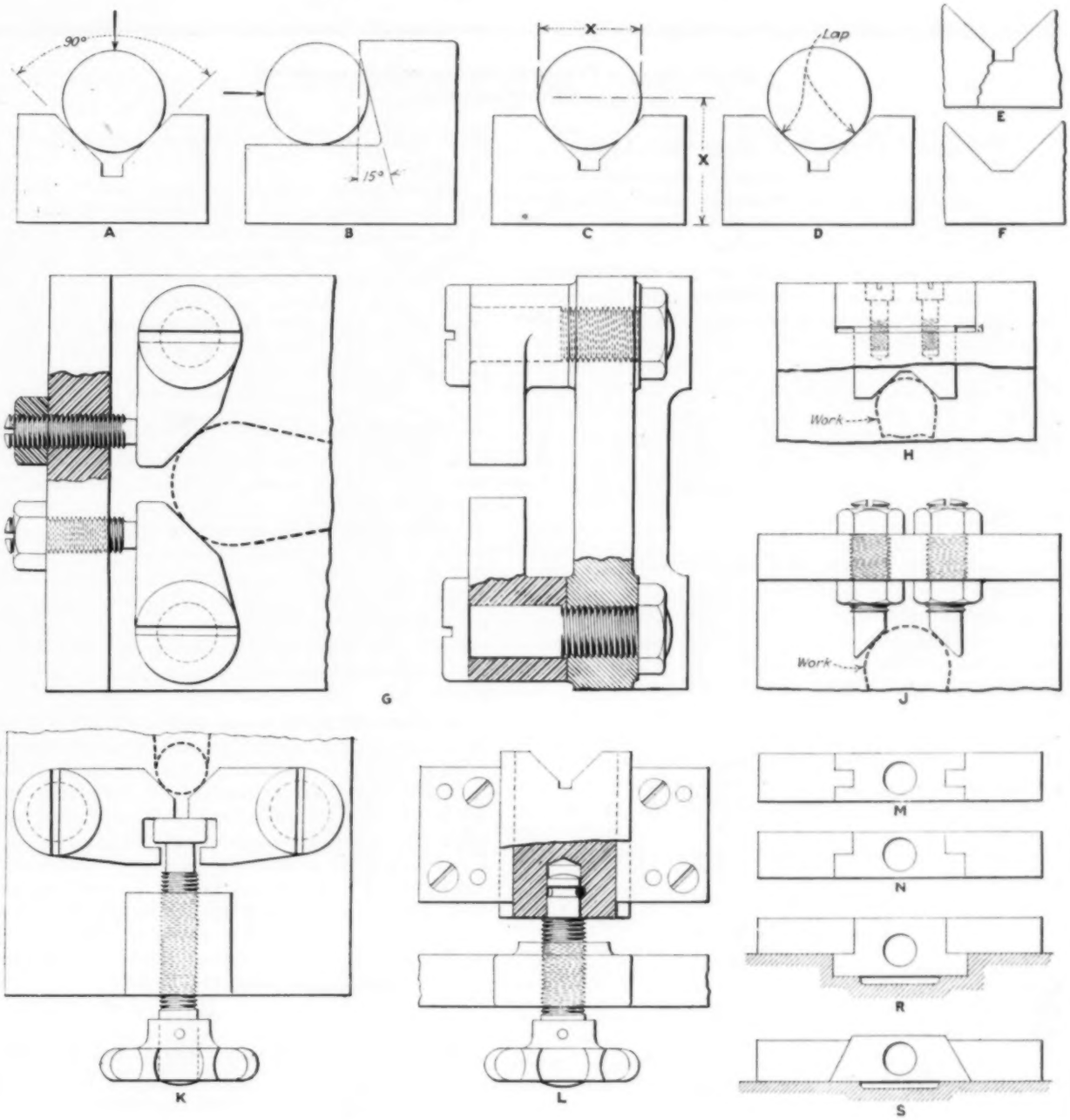
By Charles Kauffman

We had some hard, tough steel to drill, and were unable to drill more than two holes with any twist drill we had in the shop.

We then took a ⅜-in. square toolbit and ground one end to fit the drill chuck. The other end was ground flat and the point was ground the same as in an old-time flat drill.

This drill was used steadily for two hours without being sharpened, and gave us no trouble whatever.

V-Block Designs for Jigs and Fixtures



A—90-deg. V-block, vertical clamping pressure

B—V-block for horizontal clamping pressures. The 15-deg. angle tends to force the work down when pressure is applied

C—How V-blocks should be dimensioned

D—For accurate location, sides should be lapped

E—Faulty design. Metal too thin below clearance groove. Block liable to break under clamping pressure. Should be thicker as at F

G—Adjustable V-block adaptable for general jig work. Good clearance for chips

H—Simple form of V-block built into fixture

J—Adjustable V-block

K—Clamping V-block for light work

L—Clamping V-block for medium work

M, N, R and S—Suggested forms for the sliding V-block shown at L

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Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Bearing Grease in Collapsible Tubes

Q. Can you give us the name of a manufacturer who puts up bearing grease in collapsible tubes? We desire to consider furnishing and recommending such grease with the small machines we build.

A. We are certain that any of the manufacturers will be glad to quote you on putting their product up for you in this manner, providing there is a sufficient quantity in prospect.

It is our opinion on the point, that it is not so important to get a collapsible tube containing bearing grease as it is to get the correct grease for your purposes in the tube. We suggest, therefore, that you investigate carefully to determine which grease is best and then approach the manufacturers to quote you on putting it up as you desire it.

Data Table on Pipe Bending

Q. We do a great deal of pipe work, and have occasion to make use of a pipe-bend table containing data on the subject. Please let us know where we can secure such a table. Our pipe is standard black steel ranging from 1 in. to 8 in. in size.

A. The standard handbooks contain a good deal of valuable information on this subject, and one in particular, Marks Mechanical Engineers' Handbook, treats on the subject completely.

We suggest, also, that you request the information you desire direct from the makers of pipe-bending equipment, who can doubtless supply you to good advantage.

Epicyclic Gearing

Q. Please define for me the meaning of epicyclic gear trains and tell me what is meant by the "sun" pinion and the "planet" pinion. I would like to also know where these gears are used.

A. We quote, in answer to your questions, from a section of Kent's Mechanical Engineers' Handbook, tenth edition, page 1657:

"Epicyclic gear trains may be defined as trains of gear wheels in which some or all of the wheels have a motion compounded of a rotation about an axis and a revolution or translation of that axis. They are used to produce high velocity ratios with few parts. The connecting link is usually called the train arm. It often rotates upon the axis of the first wheel of the train. The last wheel of the train may or may not be placed upon this axis. The epicyclic train is so called because one gear describes epicycloidal curves relative to the other gear. The name has no connection with the form of the gear teeth, which may be of the cycloidal, involute or any other system."

The center gear of the train about which the others rotate is known as the "sun" gear. Those which rotate about this center gear are known as the "planet" gears, or pinions.

We are unable to give you more definite information without knowing what your particular problem is, but as the matter stands, we would have to fill a good many pages with general definitions, and we suggest that you secure one of the engineering handbooks, such as Kent's, from which we have just quoted, or Machinery's Handbook, published by the Industrial Press, New York, N. Y. In both of them the whole problem is treated in detail.

Shrinking a Cylinder on a Brass Lining

Q. We have a pump cylinder that has become so badly worn that we have decided to line it with brass. To this end we have bored it ¾ in. oversize on the diameter above its original 12-in. measurement and have a bushing ready to machine to fit. Please tell us if we can expect to successfully make a shrink fit by machining the bushing a bit oversize and by then heating the cylinder so it can be set in place. The question in our minds is whether the different coefficients of expansion of the cast iron and brass will have any effect on the final result.

A. There is a chance that the lining will be loose in the cylinder after the shrink fit is completed. The cylinder having a much larger mass than the lining may hold sufficient heat to bring the temperature of the latter up very considerably. This will cause it to enlarge and due to its higher coefficient may set up in it a crushing effect as it comes against the cylinder. Then when the two cool down, the lining may shrink away from the cylinder, again due to its greater coefficient. This is more or less of a guess on our part but we believe it worth considering when you decide on a means to secure the lining tightly.

Use of a Magnet in Hardening Toolsteel

Q. We have heard that a magnet can be used in connection with heat-treating toolsteel and would like to know the particulars and any limitations to the plan.

A. When toolsteels reach their critical point in the heating furnace they lose their magnetism. This point of change in magnetic property can be checked with an ordinary horseshoe magnet by suspending it on a hook and putting it into the furnace against the steel being heated. There will be attraction between magnet and steel until the critical point is reached. The steel, providing it has been thoroughly heated, is then ready to quench.

The magnet should not be held in the heat any longer than necessary to make the touch test, and it cannot be used to detect overheating since at temperatures above the critical point the magnetic property will not return to the steel.

Technical Abstracts

Cleaning Castings

The cleaning of castings by hydraulical pressure as practiced at the plant of the Allis-Chalmers Manufacturing Co., compared with the old hand method of cleaning castings, is discussed by E. C. Barringer. The hydraulic method is a matter of minutes where hours were needed.

Castings up to the largest size poured by this manufacturer of turbines, motors and heavy machinery of every sort, are swung by a traveling crane into a concrete chamber and deposited on a turntable. A workman pushes a button and a three-section telescopic roof closes. Another button and the doors at one end swing shut. A third button and a 6-stage centrifugal pump unlimbers. A stream of 425 lb. pressure, powerful enough to drive through a nozzle balanced so well that one man directs it, is turned on.

The flint-hard core is dissolved as though it were so much sugar and a flood of ink black water comes rushing out and down into the settling basins below. Gaggers and short lengths of rail, used as supports, come hurtling out. In an incredibly short time the casting is entirely cleaned, ready to be lifted out and sent to the machine shop. In general, two men now do the work of 60. A hydraulic turbine runner, weighing 110 and 40 tons before and after cleaning, is now handled in 14 instead of 300 hours.—*Iron Trade Review*, Nov. 19, p. 1267.

Training Engineers

Sir William Ellis, president of the Institution of Civil Engineers of Great Britain, is a firm believer in a sound literary and classical education for engineers. The foundation of character, he says, is a liberal education and he believes that the "modern side" is proving less capable of turning out the men that the world needs than the old "classical side." We are educating men but we are not cultivating them and that is the outstanding weakness of the existing system.

Sir William further states that it is impossible, in the face of the remarks that are made so frequently nowadays by eminent employers, not to feel that something is lacking in our present system of educating and training engineers. The general manager of a British railway, for example, is constantly looking around for good men and is experiencing a difficulty in finding them. He also places emphasis on the value of the workers training the apprentices with whom they come in contact, teaching them willingly, talking freely with them about their work and domestic life. Such knowledge is invaluable to the boy in after life when he is in a position of authority over large bodies of workmen. This contact with men of varying character will be of the greatest value to him when he will be able to understand the viewpoint of his men and to avoid many troubles because of this knowledge.—*The Engineer* (England), Nov. 6, p. 493.

Accident Increase

Experience seems to have demonstrated that industrial accidents increase in number as plants get busier and that they diminish as business falls off. Some observers maintain that the contrary is true, that when times are dull men and women grow more careless. But industrial records of the Worcester, Mass., experiment bear out the first statement.

In this city the local safety council conducts what is known as the lost-time accident contest in which close to 50 plants employing a total of more than 25,000 persons are competitors. Each month every plant reports its average number of employees, the number of accidents and the time lost because of them. The loss of even one day's time counts as an accident. These items are resolved into percentage of accidents to the number employed, and the number of lost time days per 100 employees. At the end of each year the firms are ranked on their twelve months' standing.

The Worcester experience is that accidents increase as plant activities increase. For example, the record of the plants included in the contest will not be so good this year as last, excepting perhaps in the matter of fatal accidents, to judge from the returns for the first ten months. Similarly, the percentage of accidents fell with the arrival of the last depression.—*The Iron Age*, Nov. 26, p. 1462.

The Locomotive

The locomotive stands almost alone in certain ways. Its lateral dimensions are strictly confined by the gage of the railway, and its weight is limited by the condition of the road and bridges at any given period. Thus it has presented peculiarly fascinating problems, and by reason of the restrictions under which it has to work has always been controlled by the unwritten law that above all else it must be reliable.

To this law engineers have had to sacrifice a good deal. It has exercised a restraining force and its influence has resulted in that caution on the part of locomotive superintendents which is sometimes mistaken for conservatism. Other engines may break down with but little consequences, but if a locomotive fails in service it may cause widespread dislocation throughout a large railway network. Another factor in the design of locomotives which reformers are apt to overlook is that of maintenance. The general manager is much more concerned with economy than with efficiency, and impresses that fact on the chief mechanical engineer. Economy and efficiency are far from being synonymous terms.

No improvement, howsoever promising it may appear upon paper, and however seductive the results of trials may be, is proved sound until it has been many months at work, and the results of its use have been balanced with the cost of upkeep and the delays it may have caused. Furthermore, as we have so often insisted, the locomotive must not be regarded alone. It is part of a system, not an isolated unit.—*The Engineer* (England), Dec. 11, p. 642.

American Machinist

KENNETH H. CONDIT AND FRED H. COLVIN
Editors

Established 1877

The Trade Association as a Credit Builder

MEMBERSHIP in a recognized and respected trade association is one of the finest credit guaranties a man or a company can have. The mere fact that one has been accorded the privilege of membership in such an organization is visible evidence that he is to be trusted.

If he resorted to shady practices or failed to pay his bills he would soon find himself outside the fold if he had ever been able to get in. Then, too, if he were not personally a fairly decent sort of citizen the chances are that he would not be invited to join.

In deciding a customer's credit rating it is well to find out how he stands in his trade association. Be sure that the association itself is all right although there is but little chance today that it is not. Then, if your man is a respected member of it, you have a good line on him as a credit risk.

Another Metric Bill

VOCIFEROUS and persistent, if not very sensible, the metric minority has managed to get another compulsory metric bill introduced into Congress. It is known as H.R. 10 and was sponsored by Representative Britten.

The new bill is much like its predecessors in the ten-year period allowed before it becomes effective; in the exemption of production machinery, tools or equipment from its provisions; and in the exemption of real estate transactions. It provides a license system to take care of certain favored ones who could thus continue to do business in the old units.

It will be worth your while to get a copy of this bill and study it. If you can devise one better calculated to confuse and hamper business transactions you deserve a leather medal.

Be sure your representatives at Washington understand your sentiments on compulsory metric legislation.

To Mediate Railroad Labor Disputes

ENCOURAGING progress toward industrial peace is indicated by the joint action of railroad management and brotherhood representatives in seeking legislation to set up better mediation machinery. In some respects the proposed machinery will not differ greatly from that now in existence. There is this to be said for the new plan: that it makes every possible provision for getting a dispute adjusted without action by the final mediation body.

The very general tendency to pass the buck to some federal organization instead of trying to reach an agreement in the particular locality where a disagreement exists, is entirely too common in the United States. The results of this tendency have often been disastrous. The railroad men are consequently to be congratulated in that they have recognized the evil of sending every dispute, no matter how trivial, to the court of last resort, and have avoided it.

They are also to be congratulated on taking the initiative in finding a way to settle their own troubles. A law that is proposed by those who will be governed by it has far more chance of success than one imposed by a legislative body that has little knowledge of the problem it is trying to solve.

Two adverse criticisms that have been voiced attack the elimination of the representatives of the public, and the failure of any method of co-ordinating the wage-fixing activities of the new committees and boards proposed with the rate-making powers of the Interstate Commerce Commission. It may well be that these two objections offset each other—that the public interest will be represented by the rates set by the I.C.C., rates that must be prime factors in any adjustment of wages.

Standardization and Progress

STANDARDIZATION and simplification continue to be misunderstood by many who ought to know better. Adopting standard sizes of grinding wheels does not mean that other sizes cannot be obtained when really needed. It simply means that makers and dealers will not carry in stock a large number of unnecessary sizes. It means less money tied up in grinding wheels, a more rapid turnover of capital and better service in every way.

When conditions change so that other sizes will serve industry to better advantage, the standards will be changed to suit the new conditions. No one now thinks of standards as infallible or fixed for all time—only that they serve the present better than a lot of hit-or-miss sizes.

Just Suppose

JUST suppose that every business concern put down in black and white its policies. To its stockholders. Partners. Executives. Employees. Those from whom it buys. And finally, those to whom it sells.

Suppose they were "no-deviation policies."

Just suppose.

Shop Equipment News

Davey "Vibrometer"

The instrument illustrated in Fig. 1, marketed by E. M. Sawtelle, 11 Broadway, New York, N. Y., has been designed by Peter Davey for the indication and measurement of vibration. The "Vibrometer" enables

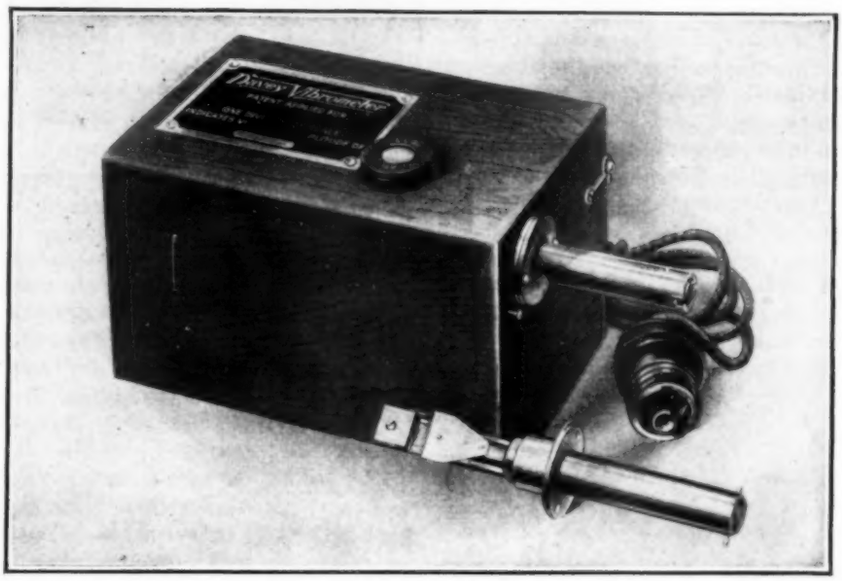


Fig. 1—Davey "Vibrometer"

manufacturers of equipment operating at high speeds to set a definite vibration limit to their products, and a check can be made by means of the vibrometer. The results are said to have a high degree of accuracy. During the work of balancing, the instrument will show the extent of improvements made in the balancing.

The identification of critical speeds is another work for which the vibrometer is intended. It will show, also, the direction of maximum vibration, whether axial, transverse or vertical.

The vibrometer consists essentially of a leaded box into which can be fitted the vibration indicating unit which has a scale. Above the scale and in the top of the box is seated an adjustable lens. The interior is illuminated by means of an incandescent electric lamp.

One of the vibration indicating units is shown in Fig. 1, beside the box, while another is inserted ready for operation. It is held in place by means of a screw and a pin. The unit is made up of a tube that houses a long pivoted lever operating a spring. The indicating end of the lever mounts a white surface with a black hairline engraved on it. The tubular housing carries, at this end, a fine scale for showing the distance of vibration of the hairline. Three interchangeable units can be provided, with ratios for various ranges of vibration amplitudes. They read in 0.0005, 0.001 and 0.002 in., respectively. The magnification given by the lens is 12, while the levers have ratios respectively of 4 to 1, 8 to 1 and 16 to 1. The total magnification of the movement is, therefore, 48, 96 and 192 for the three levers. They are said to have a low inertia, since they are lightly constructed, so that they will follow very high frequency vibrations.

In operating the instrument, the box may be held in the hand, or it can be mounted on some object that is immune from the vibration to be measured. A piece of shock-absorbing rubber can be used for mounting the box. The pin on the end of the lever is held in contact with the vibrating part. Rapid movement of the lever causes the hairline to show a blur between the two extremes of its vibration, as illustrated in Fig. 2 at *A*. The extent of this movement can be read through the lens on the scale beneath it.

The vibrometer can be combined with the vibroscope, previously described on page 834, Vol. 63, of the *American Machinist*. With this combination, vibrations can be completely analyzed as to frequency as well as to amplitude.

A vibroscope lamp is substituted for the incandescent lamp in the box. Its lead wire is plugged into the transformer of the vibroscope, which operates on the stroboscopic principle. If the vibroscope interruptor is driven from the machine of which the vibration is to be tested, and if the vibroscope is set to give two flashes per revolution of the machine, then the hairline of the vibrometer indicator will be illuminated by rapid light flashes at twice the frequency of the vibration. The hairline, instead of appearing as in Fig. 2 at *A*, will be clearly seen in a double image as shown in Fig. 2 at *B*. The maximum separation of the two images will be reached when the vibroscope interruptor has been set at the right point in its revolution to catch the vibrating part in its extreme position.

If the double image appears stationary, the vibration is in synchonism with the shaft. With the interruptor still set to give two flashes per

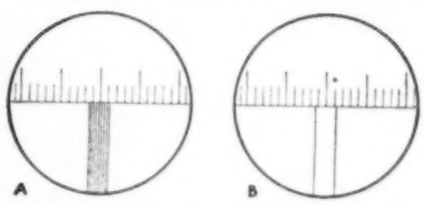


Fig. 2—Appearance of the hairline beneath the lens

revolution of the machine, if the double image disappears and reappears in beats, it indicates that there are two or more frequencies involved. In many cases, by timing the beats, the difference between two frequencies may be determined. In seeking the frequency of a vibration, the cause of which is unknown, the vibro-

Shop Equipment News

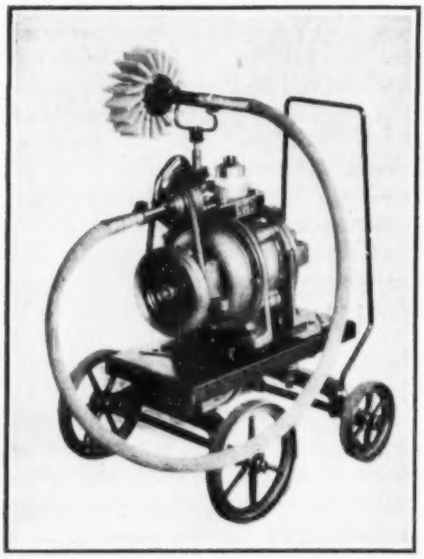
scope may be driven by an independent variable-speed motor.

The driving motor may be regulated in speed until a stationary double image appears, at which point the speed of the motor is to be noted and will give a direct reading of the frequency of the vibration. The vibrometer and the vibroscope each can be carried in a portable case.

Both of the sets are self-contained units and they can be operated from the ordinary lamp circuit.

Strand Auto Body Buffing Machine

A flexible shaft machine for buffing auto bodies is being manufactured by N. A. Strand & Co., 5001 North Lincoln St., Chicago, Ill. The shafting is driven from a 1-hp. electric motor that is mounted on a



Strand Auto Body Buffing Machine

four-wheel truck and swivel base. A belt on three-speed cone pulleys is used to rotate the shaft.

The equipment operates a Strand "multipad" buffing wheel which was previously described on page 482, Vol. 62 of the *American Machinist*. The buffing wheel is 8 in. in diam. and 3 in. wide. It is fitted with small felt pads to bring the final finish of the body to a high luster. The wheel is not intended nor designed for removing the so-called "orange peel effect" from lacquered finishes.

"Tycos" High-Resistance Pyrometers

Four improved high-resistance pyrometers have been placed on the market by the Taylor Instrument Companies, Rochester, N. Y. Figs. 1, 2 and 3 show respectively the bi-record recording pyrometer, the automatic pyrometer controller and the wall-type indicating pyrometer. A single-record instrument, not illustrated, is included among the developments.

The two recording models are similar in construction, but the bi-record pyrometer is essentially two instruments under one cover, employing two independent millivoltmeter movements. The instrument is housed in a heavy two-piece aluminum case furnished in black enamel. Glass-covered openings are provided at the top and front of the case cover to provide light and visibility of the record.

The record charts are 6 in. wide and will give a continuous record for a 1,200-hr. period. They are divided into 24-hr. periods, and sections can be removed as desired. The bi-record chart provides for two records, the width of scale for each being 3 in. wide.

The recording mechanism consists of a depressor bar that carries the temperature scale. An aluminum pointer beneath the bar is depressed periodically across an inking thread to record the temperature. This thread is 0.024 in. in diam. and is unwound from a spool like a typewriter ribbon. Its rate of travel across the chart is in direct proportion to the speed of the chart. The record has the appearance of a solid pen-drawn line.

Either a 48-hr. spring clock or an

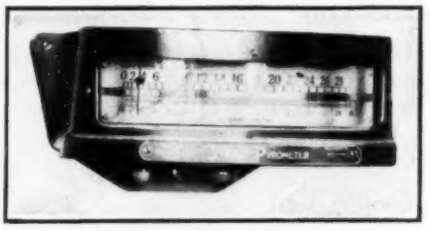
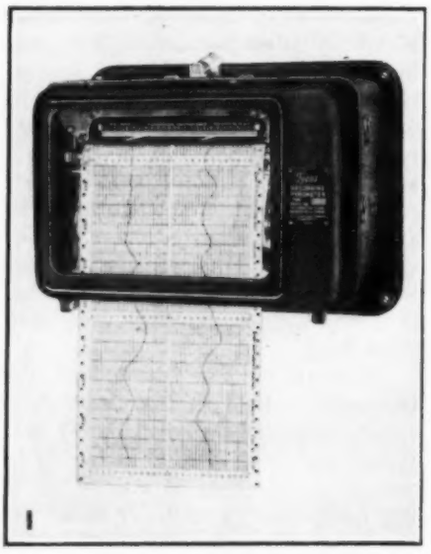


Fig. 3—Wall-type indicating pyrometer

electric clock for 110- or 220-volt, a.c. current can be supplied for the instruments. Snap openings are provided outside the case for zero settings and for clock winding. The weight of both models is 26 lb. and the size is 14x10x9½ inches.

The indicating pyrometer, shown in Fig. 3, is a pivoted-coil instrument. The coil is jeweled with Ceylon sapphires which rotate between two polished tungsten-steel pivots.

When used in conjunction with base-metal thermocouples, the meter has a total resistance of from 300 to 900 ohms. When used with platinum-rhodium thermocouples, the



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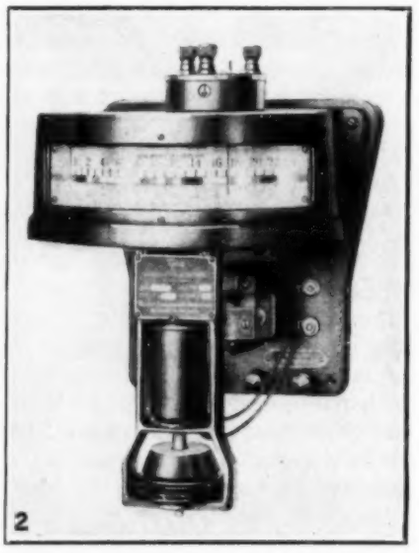


2

Fig. 1—"Tycos" High-Resistance Recording Pyrometer. Fig. 2—Automatic pyrometer controller

Shop Equipment News

total resistance approximates 150 to 300 ohms.

The mechanism is housed in a two-piece aluminum case that is said to be moisture and dustproof. A screw zero adjustment is provided. A 6½-in. double scale is supplied. A reflecting mirror prevents errors in observation due to parallax. The pointer is of target and knife-edge construction. The weight of the machine is 8 lb. Its length is 9 in., height 4 in. and depth of case is 8½ inches.

The automatic pyrometer controller, shown in Fig. 2, is essentially an indicator equipped with a temperature control apparatus and, optionally, a signalling device. It has a presser-bar mechanism actuated by a solenoid device that is, in turn, controlled by a synchronous electric-clock motor causing the presser bar to function against the controlling contacts twice per minute.

The temperature setting is adjustable to any part of the scale range of the controller. It is claimed that the temperature control will be within plus or minus 10 deg. F. on any scale setting when the valve or electric-heating coil of the furnace is correctly adjusted.

The signal device consists of an exterior set of three colored lamps, that can be located at any desired distance from the instrument. The controller will also operate electric signal bells or gongs with or without relays.

The controlling instrument itself requires a circuit of 110 or 220 volts, 25- or 60-cycle a.c. current. The controller contact arm will operate either a.c. or d.c. equipment through relays, since it is independent of the rest of the circuit. For signalling lamps, no outside relays are required. The contacts of the instrument normally will carry ½ amp. of current. The size of the controller is 8½x9x9 in., and its weight is 15 pounds.

Accessories and additional equipment for use in connection with the instruments are manufactured by the company.

Relays can be provided for use with the instrument as a straight controller for opening the solenoid valves and contactors. Thermocouples and solenoids for use with the instrument are supplied extra.

Société Genevoise Measuring Microscope

The Société Genevoise d'Instruments de Physique, of Geneva, Switzerland, has developed a micrometer microscope of the Fraunhofer type, which is being marketed in this country by the R. Y. Ferner Co., Investment Bldg., Washington, D. C. The instrument is suitable for the measurement of small machine parts, fibres, mesh of textiles, pitch and diameters of small screws, diameters of holes and for the observation of the characteristics of metallurgical samples and the deformation of test pieces. It will perform angular as well as linear measurements.

The microscope tube is mounted in a slide the ways for which are a part of a rotating table. The angular position of the table is read by means of a vernier that gives 10-min. intervals on a circle graduated in degrees. The slide is moved by means of a micrometer screw having

Société Genevoise Measuring Microscope

either a millimeter pitch or 20 threads per in. The micrometer head of the metric instrument has 100 divisions and by means of a vernier can be read to 0.001 mm. The divisions of the head for the inch thread are 0.0005 in. and the vernier permits readings to be made to 0.00005 in. The micrometer screw has a range of 30 mm. or 1.2 in. The millimeters or twentieths of an inch are read from a scale beside the slide on the side toward the observer.

A reticle of two crossed spider threads, at an angle of 60 deg. is provided in the field of the eyepiece, by which the settings are made. This reticle is adjustable transversely to the axis of the micrometer screw, which makes it possible to set the intersection of the threads on the center of rotation of the circular table. The provision for rotating the circular table carrying the slide and microscope to any position makes it easily possible to measure the dimensions of small objects in any orientation without the trouble of moving the object carefully to a required position.

The microscope is regularly supplied with Koristka objectives of 30 mm. focal length, having a magnification of 3 times, while the Ramsden eyepiece has a power of 8.3 so that the total magnification is 25 times.. Royal Society threads, in general use on microscopes, are supplied on the tube and objective so that other objectives of higher powers such as are used on biological microscopes can be substituted when the dimensions of small particles, such as sand or cement, are desired. The eyepiece is also of standard diameter to permit the substitution of higher powered lenses.

The working distance of the objective regularly furnished is 38 mm., or 1½ in. A rack and pinion are provided for focusing the instrument which allows movement of the objective through the distance of from 26 mm. or 1 in. to 64 mm. or 2½ in. above the glass plate for support of the objects. This provides for measurements upon the surface of objects up to 1 in. thick. However, larger objects can usually be measured, when desired, by means of an added feature of the instrument. The table in which the tube is mounted can be tilted through 90 deg. so as to point the microscope tube horizontally. This permits measurement on the vertical face of objects set on the stage of the instrument, since the glass stage is not tilted in this movement of the microscope tube and table.

A definite stop is provided for setting the tube in the horizontal position, while an adjustable abutment

Shop Equipment News

screw is provided for defining the perpendicular position. The friction of the hinged joint can be regulated by means of a pin key provided with the instrument. The diameter of the ground glass plate in the stage for the support of objects is over 3 in., while a 2-in. adjustable plane mirror is provided below.

The eyepiece tube is a draw tube and is provided with a clamping ring and milled-headed screw. A clamp is also provided for the focusing adjustment, so that there may be no danger of a change in focus during a measurement. The rotating table can also be clamped to the circle. The nut on the micrometer screw is cylindrical in form and is slit for part of its length to eliminate backlash, while the play of the screw in its bearing is adjustable. The graduations of the micrometer head and the vernier are on silver. Two milled heads are furnished on the micrometer screw, a small one for rapid rotation and a large one for making the fine settings.

The instrument as designed is stable and has 6 in. spread of the feet of the base, while the distance from front to back is 6½ in. The maximum height of the instrument is 12 in. The net weight is about 15½ lb. The microscope is furnished in a polished hardwood case.

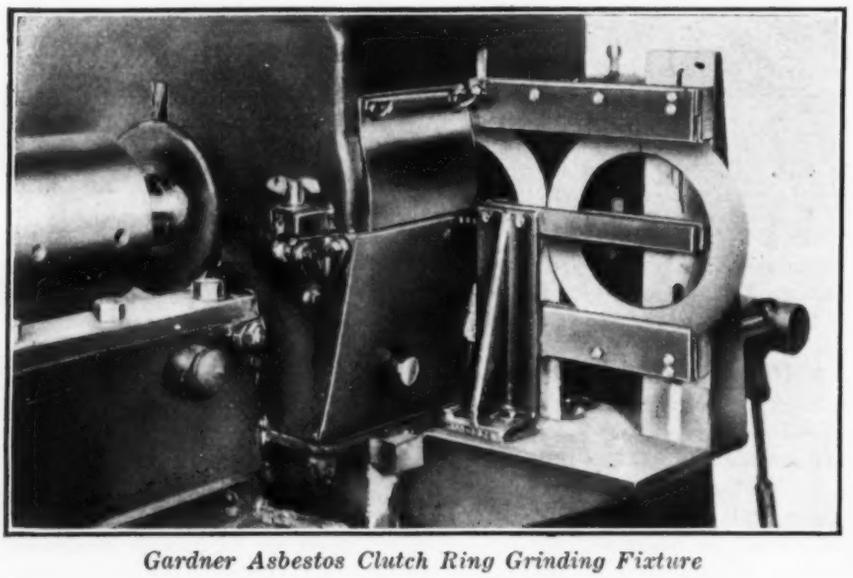
Gardner Asbestos Clutch Ring Grinding Fixture

The No. 14 disk grinding machine has been adapted by the Gardner Machine Co., Beloit, Wis., for the facing of asbestos clutch rings. The illustration shows the special fixture applied to the machine.

The fixture used consists of steel guide bars passing through between the two opposed grinding members. It is rigidly supported at the front and at the rear of the machine. The clutch rings are fed through the fixture by hand, since the material is too flexible to lend itself to automatic feed.

Both sides of the ring are ground down to proper thickness and parallel. It is said that the rings are ground with an accuracy of 0.005 in. uniform and 0.004 in. parallel. The stock removal is from 0.020 to 0.030 in. on rings with an outside diameter of 9¾ in. and 6¾ in. in inside diameter.

The grinding machine carries two grinding heads with steel disk wheels 20 in. in diam. The grinding members are Gardner special-bond, heavy-type G.I.A. disks made to conform with the requirements of the particular job. Both heads are movable and have micrometer adjustment. They are held stationary during the grinding operation by spring tension. The machine is equipped with a dressing device mounted on the machine hood. It permits truing of the grinding members without disturbing the set-up. The weight of the machine is about 4,000 lb., and it requires an operating floor space of approximately 6x8 feet.

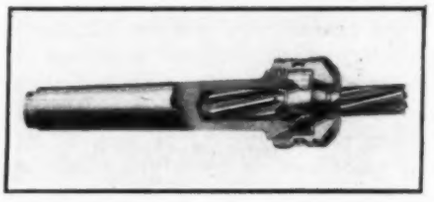


Gardner Asbestos Clutch Ring Grinding Fixture

Thurston Chuck and Double-End Mill

The Thurston Manufacturing Co., Benedict St., Providence, R. I., has brought out a type of double-end milling cutter that is designed not only to conserve material by doing away with the necessity for a shank, but to reduce production time for the user by rendering necessary trips to the cutter grinder less frequent. When a mill is broken, or becomes dulled in service, it may be renewed by merely turning it end for end.

The complete device consists of a special collet, or ring-chuck, with a taper shank to fit the spindle of the milling machine, which is capable of gripping the cutter by an enlarged shoulder midway of the length of the latter. This shoulder is made with beveled corners, as may be seen in the illustration, so that it is gripped between the two opposed beveled surfaces of the collet and ring when the screw-ring is tightened.



Thurston chuck and double-end milling cutter

The opposed beveled surfaces serve to locate the milling cutter centrally and to hold it rigidly. Two substantial driving lugs, made integral with the shoulder of the mill and engaging corresponding driving slots in the face of the collet, insure a positive drive.

The collets are made in five sizes, with a range of taper shanks to suit the customer's requirements. The mills are made in sizes ranging from ¼ to 1¼ in. in diam., with straight flutes or with right- or left-hand helical flutes as desired. The line includes two-lipped, center-cut mills as well as mills with the standard number of cutting lips.

Shop Equipment News

American Hydraulic Broaching Press Type V-18

The type V-18 hydraulic press, illustrated, has been designed by the American Broach & Machine Co., Ann Arbor, Mich., for broaching, assembling and straightening work. The ram is driven through a hydraulic cylinder and the pump is driven by a motor.

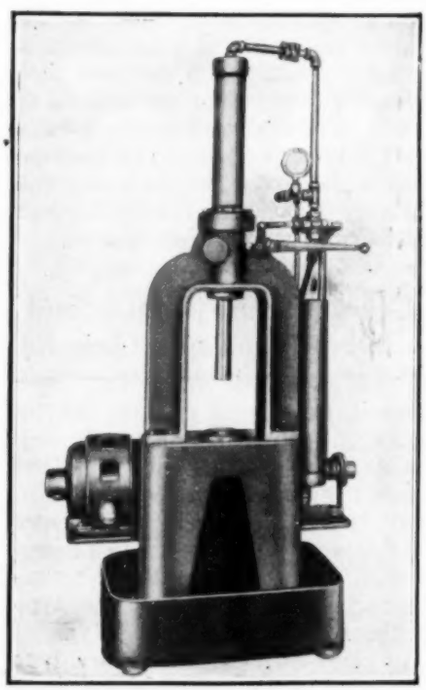
The ram is 2½ in. in diam. and has a stroke of 18 in. Stops are provided to regulate the length of the stroke. The end of the ram is tapped to receive regular broach connections. The table is bored central with the ram, the hole being 5 in. in diam. A reducing bushing is supplied with the machine.

A throttle valve regulates the flow of oil to the cylinder, which is 4 in. in diam. The speed of downward travel may be varied from 0 to 16 ft. per min. The ram is returned by means of springs that will automatically return to the loading position at the end of the stroke.

The capacity of the press is from 6 to 8 tons. Where it is desired to operate under a certain pressure, a relief valve on the machine can be set so that the pressure will not be exceeded. A gage calibrated in pounds and tons is provided so that a direct reading of the pressure can be obtained.

The pump supplied is of the twin-screw type having two rotating members which are always submerged in oil. It has no packing glands under high pressure. The flow is constant.

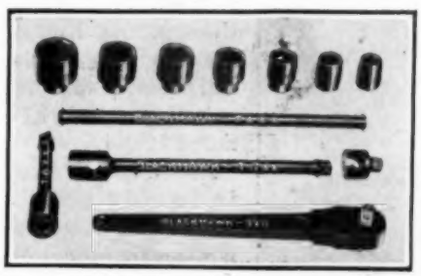
A 5-hp., 1,750-r.p.m. motor is recommended to drive the pump. The two units are connected through a flexible coupling and mounted on a platform behind the machine. Foot-treadle control can be supplied extra. The weight of the machine is 1,900 lb. and the operating floor space required is about 5 square feet.



American Hydraulic Broaching Press, Type V-18

Blackhawk Quick-Detachable Wrench Set, No. 12

The Blackhawk Manufacturing Co., Milwaukee, Wis., has placed on the market the No. 12 quick-detachable industrial wrench set, illustrated, to be known as the "extra heavy-duty" set for service in power plants and railway shops.



Blackhawk Quick-Detachable Wrench Set No. 12

The set includes a 20-in. ratchet wrench handle, one sliding bar 1 in. in diam. and 24 in. long, one short extension ¾ in. in diam. and 9 in. long, one 18-in. extension, one offset adapter, and seven hexagon sockets for bolts ranging from 1¼ to 2⅜ in. in size. The pieces are contained in a wooden box and the weight is 46 pounds.

Dill Slotting Machines

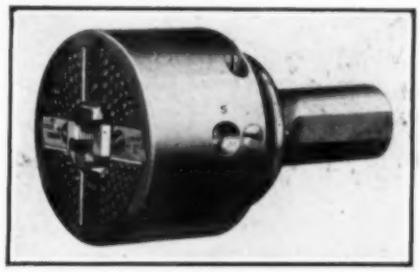
The Nazel Engineering & Machine Works, 4041 North Fifth St., Philadelphia, Pa., has purchased from the T. C. Dill Machine Co., all rights and titles to the Dill slotting machines.

They will be manufactured at the Nazel plant in Philadelphia.

"Namco" Self-Opening Diehead, Style R

The style R "Namco" diehead has been designed by the National Acme Co., Cleveland, Ohio, for use on multiple-spindle automatic screw machines or on other equipment where a revolving die is required. It supersedes the No. OH-64H diehead previously manufactured by this company.

The diehead is hardened and ground throughout and is designed to utilize a minimum number of parts. It can be taken apart by means of a special wrench provided and a screwdriver, for cleaning or replacing worn parts. The chasers are opened and closed by means of cams on the inside wall of the cup or hood, on the back of which is integrally secured the spool for controlling the opening of the chasers. An attachment in the form of a fork fitting into the spool is used to operate the diehead.



"Namco" Self-Opening Diehead, Style R

The adjustment for proper cutting ize is secured by means of two parallel adjusting screws located in the side of the hood, and can be done without removing the tool from the machine. Loosening one screw and tightening the other gives the adjustment which can be measured by the micrometer on the hood. The two screws bear on lugs on the back of an adjusting plate. This plate is located in the body by means of a pin. Clearance for oil and chips is provided by means of a lug that rides over the bottom of the body.

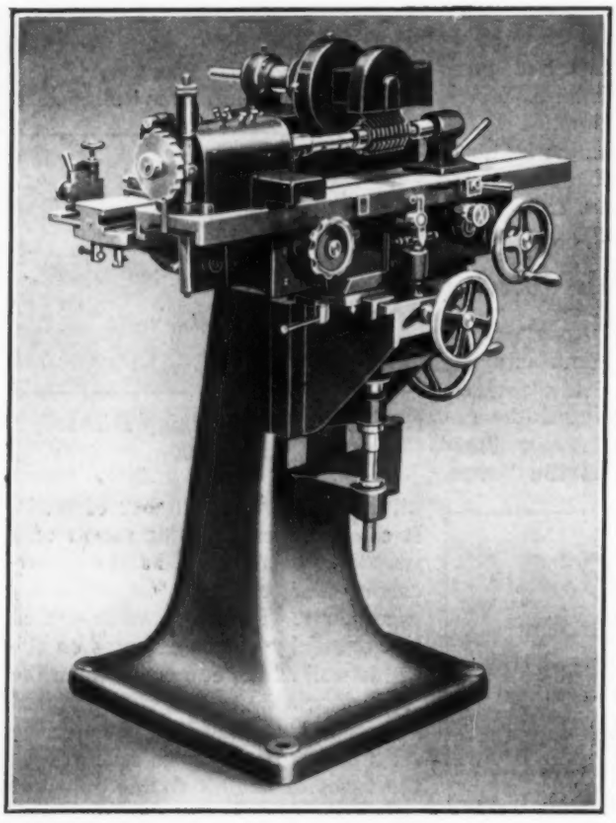
The chasers, which are interchangeable with those of the former model, are of the overhang type to permit threading close to a shoulder and to throw the chips outward.

The style R dieheads are built in seven capacities for cutting diameters of from ⅛ to 2½ inches.

Shop Equipment News

Schuchardt & Schütte Automatic Hob Grinders

Two sizes of automatic hob grinders, manufactured by Schuchardt & Schütte of Berlin, Germany, have been placed on the market in this country by George Scherr, 142 Liberty St., New York, N. Y. The hob grinders, one of which is illustrated, are designed to reduce the time consumed in starting and stopping the machines while indexing.



Schuchardt & Schütte Automatic Hob Grinders

Both the travel of the table and the indexing of the hob are automatic, and the operator has only to feed the tooth of the hob toward the grinding wheel from time to time. It is said that one operator can handle several machines, according to the size of the hob. Radial grinding of the cutting edges is performed and high accuracy is claimed for the machine.

The knee is moved vertically by means of a handwheel, and another is used to adjust the cross-slide. The movement of the table can be either automatic or by hand. The automatic travel is engaged by means of a coupling pin in the table gear box. By withdrawing this pin, the automatic table travel is tripped. The length of table travel can be adjusted by means of movable stops.

As the table moves back and forth the hob is slightly rotated at a rate corresponding to the spiral lead of the flute. This movement is provided by means of a square guiding bar that is set by degrees to the exact helix angle of the flute. The table is arranged to swivel 15 deg. either side of the normal to take care of right- and left-hand spiral flutes. The graduations are in 10 min. of a degree. When the guiding bar is set at zero, the table will move parallel for grinding straight-fluted cutters.

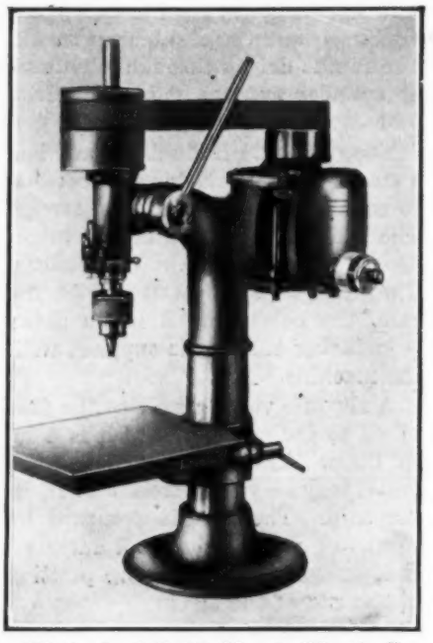
An improved spiral indexing head is used. The indexing is done by means of dividing plates which have a number of circles. The feeding of the cutter toward the grinding wheel is done by means of a handwheel. The cutter is fed radially in order to avoid distortion of the profile shape. The grinding wheel spindle runs in ball bearings.

The machines are equipped with dust exhaust that deposits the dust in a water tank. They can be equipped for either belt or motor drive and will accommodate hobs up to 6¼ and 9⅞ in., respectively.

Winterhoff Drill, No. 0 "Junior"

The No. 0 "Junior" drilling machine is manufactured by the Winterhoff Tool and Machine Co., Elkhart Ave. and Jackson St., Elkhart, Ind. It is driven by a ¼-hp. motor, similar to that used on the No. 1 universal saw and sander described on page 37, Vol. 64 of the *American Machinist*.

The driving motor, rotating at 1,750 r.p.m., operates the machine through a 1¼-in. endless belt. The motor is mounted on a hinged support so that the belt tension can be adjusted by means of a thumbscrew. A belt guard is provided on the machine.



Winterhoff Drill, No. 0, "Junior"

The spindle is mounted in ball thrust bearings, and means are provided for taking up end and side play. The travel of the spindle is 2¼ in. The distance from the spindle to the table is 7½ in. The machine has a table 8x9 in. in size. The height of the drill is 25½ in., and 85 lb. is the weight of the machine.

Geometric Adjustable and Collapsing Taps, Class S

The Geometric Tool Co., New Haven, Conn., has brought out its class S, adjustable and collapsing taps. In Fig. 1 is illustrated the class S hand-machine type equipped with a trip plate and Fig. 2 shows the class SB rotary type with a flange trip. This company also is manufacturing the hand machine type without the trip plate, which is called the class SC, and the rotary type equipped with a trip plate and without the closing handle, called the class SA. Each of the models can

Shop Equipment News

be converted and its parts interchanged with those of the others.

The front ends of the taps are of large diameter to increase the strength. Chip clearance grooves have been milled in front of each of the four chasers to permit the chasers to cut freely and without packing. The mechanism is completely inclosed and protected against dirt.

The chasers are designed so that their thickness will provide a long grinding life and are short in order to enable the use of a heavy front-end construction. They are supported

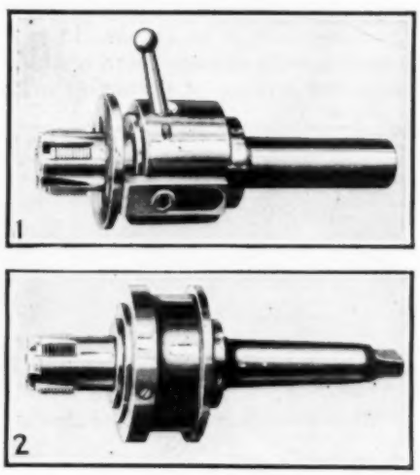


Fig. 1—Geometric Adjustable and Collapsing Taps, Class S. Fig. 2—Rotary Tap, Class SB

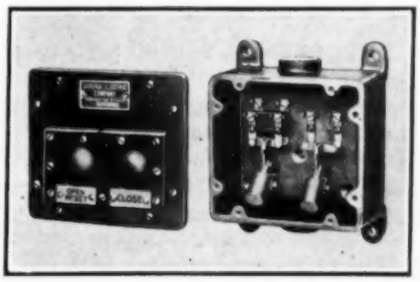
along their full length. A cap with four screws is provided to hold the chasers in place. They can be provided for either bottoming or plug tapping.

In the hand machine type, illustrated in Fig. 1 with the trip plate, contact with the work at the required time collapses the chasers. The resetting is done by hand. The rotary type, shown in Fig. 2, has a flange fitted over the closing sleeve for the purpose of collapsing and resetting the tap.

General Electric Dust-Tight Push Buttons

The General Electric Co., Schenectady, N. Y., has placed on the market a special push-button switch for alternating-current circuits in connection with dustproof, inclosed, magnetic starting switches.

The push button has a cast-iron case with a flexible leather gasket



General Electric Dust-Tight Push Buttons

over the buttons. Each button is operated by pressing on the leather directly over it. The leather can be kept flexible by occasional applications of neatsfoot oil.

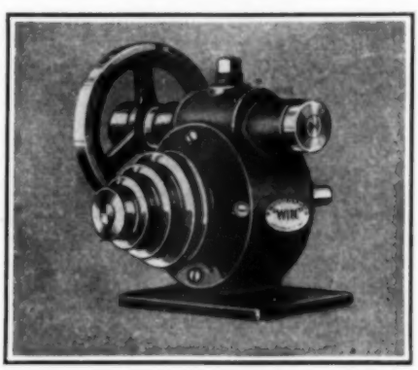
The station can be mounted either vertically or horizontally. It was originally designed for marine use where subject to a spray.

Smith Reducing Gears Type 2

The type 2, small reducing gear manufactured by Winfield H. Smith, Springville, Erie Co., New York, has been improved, as have the Nos. 4A, 5 and 8. The type 2 reducer retains the same center distances, shaft sizes and shaft extensions as the former model.

The unit is equipped with bronze-bushed bearings for the high-speed shaft. The gear case provides for a greater oil capacity and is more rigid in construction. A screw plug at the top of the case provides for filling the chamber.

Gear reduction of 48 to 1 or 30 to



Smith Reducing Gears, Type 2

1 can be had. The unit is regularly equipped with a 5-in. grooved pulley on the drive shaft and four-step grooved pulleys of 1, 1½, 2 and 2½ in. on the driven shaft.

United States Portable Electric Drills, ½-Inch

Two ½-in. portable electric drills have been brought out by the United States Electrical Tool Co., Cincinnati, Ohio. Fig. 1 shows the ½-in. heavy-duty model, while the ½-in. special drill is illustrated in Fig. 2. The former is of heavier construction to stand up under more severe requirements. The latter is for general, all-purpose work.

Both tools have a spade handle which can be removed by loosening either of two screws so that the drill can be secured to the adjusting screw of an "old man."

The motors are designed to operate the drills at 450 r.p.m., full-load speed. Three S.K.F. ball bearings are provided. A ball thrust washer is placed behind the drill chuck.

The motors are controlled through a trigger switch originally patented

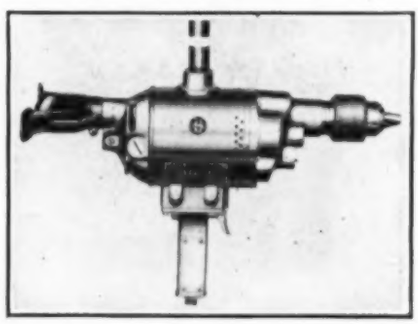


Fig. 1—United States Heavy-Duty Drill, ½-Inch

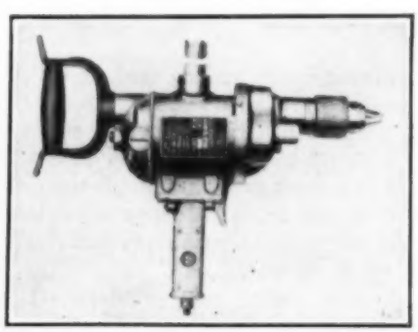


Fig. 2—Special portable electric drill, ½-inch

by this company. The switch has an "on and off" indicator, the "off" position being indicated when the arrow is crosswise to the line. Ventilation is provided for the motors. They are universal to operate on d.c. current or a.c. current of 60 cycles or less.

Shop Equipment News

Gaterman Pneumatic Oscillating Tapping Machine No. 8, Improved

The W. Gaterman Manufacturing Co., Franklin and 15th Sts., Manitowoc, Wis., has placed on the market an improved No. 8 pneumatic oscillating tapping machine. The former model was previously described on page 496, Vol. 59, of the *American Machinist*.

The present design has the same principles of construction and operation as those of the former models. All rotating parts have been inclosed in guards, so that foreign matter

Gaterman Pneumatic Oscillating Tapping Machine, No. 8 Improved

cannot enter and so that no oil will be thrown.

Those machines that are equipped with an oil pump are provided with a fine mesh combination strainer and chip pan mounted beneath the table. It can be quickly removed and cleaned when necessary.

The motor or countershaft is mounted on the oil tank which is now cast integral with the base of the machine. A hose with an air blow gun is furnished as standard equipment.

The capacity in steel of the No. 8 machine is from $\frac{1}{4}$ to $\frac{3}{4}$ in. With a back-geared attachment, it is $1\frac{1}{4}$ in. The tapping depth can be up to 3 in., and with a special arrangement can be up to 9 in. The distance from the spindle to the column is 13 in. The table, inside the oil channel, is $22\frac{1}{4}$ in. in diam. Vertical adjustment of the table is 21 in. Spindle speeds of 195, 275, 390 and 670 r.p.m. are available. The height of the machine is 70 in., and its weight about 1,000 lb. A $1\frac{1}{2}$-hp., 1,750 r.p.m. motor is standard equipment.

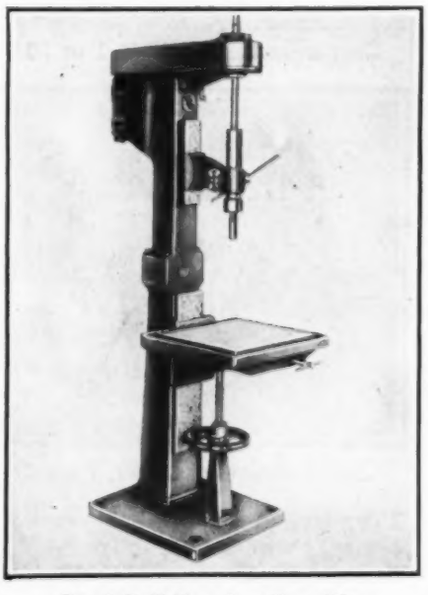
Reed Ball Bearing Sensitive Drilling Machines

The Francis Reed Co., 41-43 Hammond St., Worcester, Mass., has placed on the market a 16-in. sensitive drilling machine equipped with ball bearings throughout. As illustrated, the machine is driven by an individual motor through an endless belt. Constant tension is maintained automatically. The drive is wholly inclosed, but easily accessible.

The standard machine has four speeds, two electrical and two mechanical, ranging from 700 to 3,600 r.p.m. Special cones can be furnished for other speeds, if desired. Single pulley drills can be supplied where the machines are to be used for single-purpose work.

Driving motors for use on 60-cycle, two-phase a.c. current of 110, 220, 440 or 550 volts are standard equipment. A self-contained switch is mounted on the machine to operate and indicate from the front. The power delivered is sufficient to operate a $\frac{5}{8}$-in. drill.

Multiple-spindle models have 10-in.

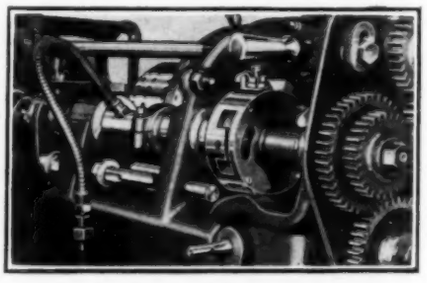


Reed Ball Bearing Sensitive Drilling Machines

from center to center. The quills are of steel and have a vertical travel of 6 in. They carry a $\frac{7}{8}$-in. spindle bored for a No. 2 Morse taper. The rack is cut into the steel quill and it has a minimum width of $\frac{3}{4}$ inches.

Cleveland Automatic Lead-Screw Control

For use in the cutting of screw threads with an accurate lead, the Cleveland Machine Co., Cleveland, Ohio, has developed the lead screw mechanism illustrated. It is intended for application to automatic screw machines and is to be used in combination with change gears when desired for a range of threading work.



Cleveland Automatic Lead-Screw Control

To the right of the tailstock spindle carrying the diehead is secured a split-nut carrier which can be seen in the illustration. This carries split nuts that engage the lead screw. The split-nut carrier moves backward and forward as the spindle advances the diehead to the work and withdraws it after the threading operation has been completed.

When the spindle has advanced the diehead to the work through the usual cam mechanism, a cam closes the split nut onto the lead screw. Rotation of this screw will then cause the nut and the spindle to feed the diehead onto the work. When the threading has been completed, the diehead is automatically tripped and the split nuts are withdrawn from the lead screw. The spindle with the diehead and nut carrier are then returned to the starting point.

The set-up illustrated has been applied to the Cleveland Model B automatic, previously described on page 638, Vol. 59 of the *American Machinist*. A magazine-feed mechanism for handling cylinder-head studs is also supplied.

News of the Week

Steel Treaters Meet at Buffalo

A series of discussions on various experiments and treatments of steel, interrupted now and then with inspection tours to large industrial plants in the vicinity, took up the three days of the winter sectional meeting of the American Society for Steel Treating, held at Buffalo, Jan. 20, 21, 22 and 23. Headquarters were in the Hotel Statler.

There were five technical sessions at which the following papers were presented: "The Laboratory as a Factor in the Inspection of Alloy and Tool Steels," by W. H. Wills, Jr., the Atlas Steel Corporation; "Influence of Changes in Carbide Concentration on X-Ray Structure of Some Pure Iron-Carbon Alloys," by Dr. W. L. Fink, the Aluminum Co. of America; "The Effect of Size and Shape on the Hardening of Steels," by H. J. French and O. Z. Klopsch, of the Bureau of Standards; "On the Nature of Alloys of Iron and Chromium," by E. C. Bain, the Union Carbide and Carbon Co.

Among the plants visited were the Donner Steel Co., the Curtiss Aeroplane and Motor Co., the Bethlehem Steel Co., the Pierce-Arrow Motor Car Co., and the American Brass Co. The annual dinner was held Thursday evening.

Edward Dean Adams Wins Fritz Gold Medal

Award of the John Fritz Gold Medal to Edward Dean Adams, of New York City, for achievement as "an engineer, financier, scientist, whose vision, courage and industry made possible the birth at Niagara Falls of hydro-electric power," is announced by the Engineering Foundation.

This medal is bestowed annually for notable scientific or industrial achievement and is the highest honor bestowed by the engineering profession in this country.

The award was made by a board of sixteen representatives of the American Societies of Civil, Mining and Metallurgical, Mechanical and Electrical Engineers.

Joint Meeting on Management

In order to further the efforts being made by prominent engineers and economists to promote a more harmonious feeling between management and labor in the railway industries, a joint meeting of several engineering societies will be held in the Engineering Societies Building, New York, on the evening of Feb. 5. Daniel Willard, president of the Baltimore & Ohio R.R. has been invited to preside.

Members of the Taylor Society, the Metropolitan section of the American Society of Mechanical Engineers, the Society of Industrial Engineers, and the New York Railway Club are co-operating in this meeting. The speakers will be Otto S. Beyer, Jr., consulting engineer; Bert M. Jewell, of the American Federation of Labor; Sir Henry Worth Thornton, president of the Canadian National Railways; and Daniel Willard.

F. A. Geier Receives Ancient Milling Machine as Unique Christmas Present

The second milling machine built by the Cincinnati Milling Machine Co. was presented to F. A. Geier, president of the company, by the employees at the Christmas celebration.

In making the presentation "Santa Claus" read a letter to Mr. Geier purporting to have been written by the milling machine detailing the difficulties and pleasures of the life that it had gone through.

The milling machine is 41 years old, having been made in 1884. At that time the shop was located on the second floor of a building at the northeast corner of Pearl and Plum Streets, Cincinnati. The company name was the Cincinnati Screw and Tap Co. The organization consisted of twelve men, each an all-around mechanic.

The machine was equipped at that time with three-step cone pulley, power feed to the table operated by cone pulleys, angular elevating shaft and universal dividing head with arbors, wrenches and cranks. The machine and dividing head were given a gold medal when exhibited at the Cincinnati Industrial Exhibition in 1884.

Captain Heinen Will Address Engineers

The New Britain section, A. S. M. E., is planning a dinner meeting for the evening of Thursday, Feb. 18, to be held in the ballroom of the Hotel Burritt at New Britain, Conn. The sections of Hartford and Meriden have been invited to join the New Britain section as its guests at this meeting, which will be addressed by Capt. Anton Heinen upon the subject "Commercial Transportation with Lighter-Than-Air-Craft."

Captain Heinen is a recognized authority upon matters pertaining to the construction and navigation of aircraft; his relations with the German Zeppelin company and his later experiences in this country in connection with the airships "Shenandoah" and "Los Angeles" of the U. S. Navy Department giving to him a prestige that renders his utterances of inestimable value.

Dean Kimball Heads Engineering Council

Dean Dexter S. Kimball, of Cornell University, was elected president of the American Engineering Council at the annual meeting in the Mayflower Hotel in Washington, Jan. 13 to 15. Dean Kimball, past president of the American Society of Mechanical Engineers, succeeds former Governor James Hartness, of Vermont.

Gardner S. Williams, of Ann Arbor, Mich., and Irving E. Moultrop, of Boston, were named vice-presidents. Dr. Harrison E. Howe, of Washington, was re-elected treasurer, and Lawrence W. Wallace, of Washington, was again chosen executive secretary.

Administrative board meetings of the council will be held in Louisville and Detroit at dates to be fixed later. A third meeting of the board during 1926 probably will be held in Richmond, Va.

Guggenheim Gives More to Foster Aviation

The announcement last week of a gift of $2,500,000 toward establishing a fund for the promotion of aeronautics, through the generosity of Daniel Guggenheim, has been followed by the naming of a board of ten prominent engineers and executives to take charge.

The ten men who will administer the fund are:

Rear Admiral H. I. Cone, U. S. N., retired, former commander of the United States Naval Aviation Forces; F. Trubee Davison, chairman of the National Crimes Commission and in naval aviation during the World War; Dr. William P. Durand, member of the National Advisory Committee for Aeronautics and professor of mechanical engineering at Stanford University; General George W. Goethals, chief engineer of the Panama Canal; Harry F. Guggenheim, formerly United States naval aviator overseas; Professor A. A. Michaelson, head of the department of physics at the University of Chicago and winner of the Nobel prize in physics, 1907; Dwight W. Morrow, chairman of the president's aircraft board of inquiry and member of J. P. Morgan & Co.; Elihu Root, Jr., lawyer; John D. Ryan, director of aircraft production and second Assistant Secretary of War and director of air service, 1918; Orville Wright, brother of Wilbur Wright and first to fly a heavier-than-air machine, now director of the Wright Aeronautical Laboratory.

The fund will be incorporated and Mr. Guggenheim will transfer to its credit a check for $500,000, to be used by the directors as their unrestricted judgment may deem best for the advancement of the purposes of the fund.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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IT IS SAID that in China men are sometimes put to death by playing upon their imagination. They are blindfolded, a lancet is snapped over the jugular vein and tepid water is dropped on their necks to create the illusion of blood. They imagine they are bleeding to death and they die. The story may not be true, but it is plausible and it is suggestive when considered in connection with business in the United States at present.

Confidence in general and continued activity seems logical, but nervousness is being created and caution is increasing because so many warnings are being issued against the overbuilding and the land booms that are reported from various parts of the country.

Those warnings are probably warranted, but by their reiteration an atmosphere of apprehension is being created and it is commencing to chill speculation on the Stock Exchange and elsewhere.

The action of the Federal Reserve Bank of New York and the New York Stock Exchange in deciding to ascertain and publish the aggregate of stock brokers' loans is another departure that has somewhat dampened speculative enthusiasm. It is generally conceded that more information ought to be available about the amount of banking capital employed in carrying securities that have been bought on margin, but there is a fear that the amount is larger than currently estimated, and that when the facts are known, they may lead to a compulsory and somewhat precipitate liquidation.

Then, too, there is to be considered the governmental disapproval of speculation that is implied in the action of the Federal Reserve authorities, as well as the attitude of the Department of Agriculture toward the commodity exchanges.

The restrictive measures applied and threatened all seem to assume that speculation is meretricious, if indeed it is not morally wrong. The value of what is called the aleatory instinct, which makes men willing to take chances in the hope of profit, is ignored and a code of economic ethics that frowns upon profits made as a result of price changes is being formulated. This may be sound, but it is also novel, and society always hesitates when it is asked to change it habits or philosophy.

These observations are the best explanation that can be offered for the reactionary tone that was discernible on most of the exchanges last week. Most of the active stocks are lower. Sugar securities have, however, been an exception, probably because of the increase in the demand for the commodity which the refineries produce.

What's Doing in Industry

The trend of business in machinery and machine tools for the first month of the year indicates the fulfillment of the many predictions made to the effect that the first half of this year would see a general revival of business in this industry.

In most localities sales have shown substantial increase, and inquiries from large industrialists, railroads and automobile manufacturers are more numerous than has been the case in many months.

The East is now about on a par with the Middle-West in volume of sales. New York dealers report an increase in sales, and good inquiries from railroads. New England business is better by 10 to 20 per cent and in Buffalo January business has exceeded December and new inquiries are still coming in for tools and shop equipment.

Detroit reports a generous increase in sales, automobile manufacturers buying high production machines and jigs and fixtures. A gain in new orders in Indianapolis and increased activity in railroad buying in Chicago are other features of this sectional prosperity. Cincinnati reports more sales with a generally brighter outlook. Milwaukee business is improving, automotive interests furnishing orders and inquiries.

Business navigators all over the country are becoming more careful, and industrial and financial conditions are showing added strength.

Wheat is also down, despite the bullish confidence of an important group of operators in Chicago. Cotton touched 20.50 for March and thereafter declined upon freer offerings and the fear that the ginning report indicates that the yield of lint cotton is about 16 million bales, which means a commercial crop, linters included, of nearly 17,000,000 bales.

Rubber has declined quite sharply. Mr. Hoover is exultant, although it is generally admitted that the United States bought relatively little rubber at over a dollar a pound.

Distributive trade has been good, though not abnormal. The offtake of cotton and woolen goods has been fully up to the production, and manufacturers are supposed to be making reasonable profits. The shoe trade is distinctly better.

It is a little difficult to get at the exact condition of the iron and steel trade, but some slackening in the demand as well as in the prices seems to be indicated. The reports of agricultural distress in the corn belt are being vigorously challenged by some of the agricultural papers, who point to the sales of the large mail order houses as proof that the farmers' purchasing power has not been impaired.

Copper continues to hang around 14 to 14¼ cents. Whether stabilization or excessive production is indicated by the inertia of the copper market is as yet an unanswered question, but there seems to be no likelihood of an advance in the near future.

The news from abroad is upon the whole encouraging, although Denmark reports some unemployment as a result of deflation. The Bank of England has been buying gold in the market, and an early increase in its reserves seems to be indicated. But the United States also has been importing gold from Japan, and the weekly statement of the Federal Reserve Banks shows an increase of $15,000,000 in the amount of gold held. The reserve ratio stands at 74.4, which is 1.7 per cent higher than it was a week ago. The American money market is steady and the advance in the rediscount rate ordered two weeks ago is apparently forgotten.

The prosperity of East India as indicated by her continued absorption of gold is one of the outstanding factors in the world's situation.

Taken all in all the ship of American business seems to be on an even keel. The winds are favorable, and although their impelling force is not quite as great as it was, it appears to be sufficient to carry us well into the spring without any substantial slackening in the speed of the vessel. But it is undeniably true that the many warnings issued have made navigators more careful and that enterprise, initiative, and speculation have been partly checked.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Detroit

Unless something unforeseen happens during the last week of January the volume of sales of the leading machinery and machine tool dealers in Detroit and southeastern Michigan will far exceed those of the corresponding period in 1925, and will give the year an auspicious start.

At present the engineering staffs of the automobile and accessory plants are laying plans for adding to their toolroom equipment. The annual meeting of the Society of Automotive Engineers scheduled for the same week as the show will serve to crystallize the needs of the industry for the coming year.

According to the machinery men in Detroit most of the larger industrial plants of the city are stocking up with small tools and standard machines which will serve a multiple purpose. No large orders for new equipment have been reported within the past two weeks, but business seems to be quite steady, with small sales reported in practically every quarter.

Business reported by the jig and fixture firms is the best in months, but the used tool market is anything but steady.

Cincinnati

While the past week has had no outstanding feature, its net results are regarded as satisfactory and encouraging by Cincinnati machine tool dealers and selling agencies. The automotive industries did not buy as much as in the previous week, but an increased number of orders from concerns in other lines more than made up for this, and the week showed an increase in sales.

Buying continues to increase in volume. After closing their books for the year a great many machine tool users have found that they have money to spend for needed equipment, and these are beginning to send in orders. Some have found that they have lost money through the use of obsolete and inefficient tools, and orders will come from many of these.

A number of inquiries were received from railroads and concerns in the textile industries during the past week. There is no spottiness in the market, either as to orders or as to inquiries, and business is evenly distributed as to sizes and types of tools.

It is reported that few machine tools are bought for business expansion; most of the purchases are for replacement, improved types being selected, with a view to increasing efficiency and reducing costs.

Milwaukee

January business in metal-working equipment is proving equal to expectations. The demand reveals few high spots, such as large-item orders, but the steady stream of single tool purchases, with a considerable number of small lot orders, has sufficed to offset the reduction of order books by deliveries. This makes for a satisfying condition and insures the operation of tool shops at or slightly above the present rate for several months longer.

It is considered significant that official employment reports continue to stress the shortage of skilled machinists. Foundry workers also are scarce. Machine tool shops find it difficult to procure the class of men they need.

A little railroad business has been booked, and there appears to be more in the foreground. Automobile shops are furnishing the most active inquiry, and new orders come largely from that industry. Renewed pressure for prompt deliveries has come from the motor car trade since the trend of business has been ascertained. Manufacturers of milling machines, turret lathes, automatic screw machines, internal grinders and gear hobbers are especially profiting from the requirements of automobile factories.

Indianapolis

A slight expansion in both machine tool and machinery business is reported since the first of the year. Leaders in the trade here say the expansion has been all that might be expected and they are satisfied that the first six months of the present year will show a gain over the same period last year.

Both Marmon and Stutz factories are steady buyers of machine tools, with both operating to capacity.

The same might be said of every farm implement factory in the state. Local machinery men report that many contemplated replacements in these factories will likely be made this year.

Demand from the railroads is much better. Since the first of the year the working hours at a number of railroad shops in Indiana have been increased and repair work is being pushed. Some inquiries are being received from fabricating plants.

Chicago

A slight decline in sales of machine tools during last week as compared with the first two weeks of this month is reported by some dealers. The decrease in business applies more particularly to metal-working machinery, the demand for wood-working tools being brisker than for some time past.

Railroad buying is looked for in large volume in the near future, the Chicago & Northwestern R.R. is reported to have appropriated a sum approximating $500,000 for the purchase of machinery and tools during this year. The list issued by the Illinois Central totals an equal figure.

Manufacturers of motor trucks and coaches are expected to enter the market shortly for new shop equipment, renewed activity in that branch of manufacturing industry having been reported.

Canada

Little business has been placed on the books of machinery and machine tool dealers in Canada since the beginning of the year, but there are indications that much new business will develop before long.

Orders of considerable importance are beginning to come from the Lake St. John district in the province of Quebec, where the big aluminium and pulp and paper plants are being built. Further details regarding the $1,000,000 car order placed by the Montreal Tramways Co. show that the car bodies and trucks will be built by the Canada Car and Foundry Co., and the air brakes and electrical equipment by the Canadian Westinghouse Co.

Thomas Bradshaw, general manager of the Massey-Harris Co. in Canada, recently made the interesting statement that while sales of agricultural implements and machinery by his company in 1925 were approximately 75 per cent greater than in 1924, the favorable harvests and improving economic conditions now existing, would indicate that 1926 would be an even more prosperous year.

New England

Business in the machinery industry in the New England section is better than at the corresponding time a year ago. Orders booked so far this year are from 10 to 20 per cent greater than at the same time last year and, while some of it represents year-end business that was held up, much of it is known to be equipment for expansion as well as for replacement.

Employment and operating schedules are improved. Estimates of additions to working forces are at figures from 3 to 8 per cent. Operations are on full time and in a number of shops overtime is in order.

Domestic business is good in every branch and no particular line stands out conspicuously. Export business continues good, Italy, France and Japan now buying.

Machine tools are selling well and inquiries indicate that this branch of the industry is going to continue well for several months at least.

New York

A substantial increase in business marks the second half of January in this market. New orders continue to come in and dealers and manufacturers agents are busier now than they have been in several months.

Most of the present business comes from industrialists, which includes manufacturers of steel products, hardware, electrical goods and automotive accessories.

Railroads are also coming into the market for equipment, the New York Central having sent out an inquiry for twenty tools in the past week. Another inquiry for fifteen tools has been sent out by the General Electric Co.

Liquidation of the equipment of the old Niles-Bement-Pond plant in Plainfield, N. J., is in process.

Much of the machinery ordered in the past week consisted of lathes, milling machines, shapers, radial drills and screw machines. There was also liberal call for cranes and miscellaneous shop equipment.

The outlook is quite satisfactory, many believing that January will equal, if not exceed, December figures in total business recorded.

Buffalo

January volume of business in the machine tool trade will be all that was expected. There are a few who report business a trifle slow, while there are many that report it fully up to expectations and better in a few cases. One dealer reports that his January business will be double that of January, 1925.

All reports indicate that inquiries are good. Most of the business is for single machines and no large amount of equipment is going to any one place.

There is considerable interest in the report that the American Radiator activities here are to be increased by a construction and expansion program which is already under way and which, it is said, will involve the expenditure of about $5,000,000.

German Machine Tool Industry Needs Export Trade

The correct perspective of the changed conditions of the world market has been temporarily lost in Germany, according to a statement to that effect made by Carl Lange, manager of the Machinery Manufacturers' Association, at the annual meeting of that body in Berlin on Dec. 4. Mr. Lange addressed the convention on the subject —"The Increasing Economic Crisis and the Means to Overcome It."

"The machine industry is the one among all German industries which has the best export opportunities, provided the commercial treaties are favorable for its development," he said. "The increasing industrialization of foreign countries reduces the export of manufactured goods, but favors the export of machinery built for the purpose of producing such goods.

"We have now too many factories when compared with the sales possibilities. For example, we have 90 to 100 lathe factories, while America has only half as many. As the domestic American market is about 5 times as large, we should have proportionately only 9 to 10 such factories, or perhaps 15 to 20 considering our relatively larger export. We have 60 railway car factories, with only 40 before the war, and we have more locomotive works than in prewar times, although the German railways are placing practically no orders and there is little chance for export. We have 53 factories for band saws, 45 for circular saws, and 28 for gang-saws.

"Unused manufacturing equipment and consequent large stocks of raw material and half finished goods, increase the cost of goods. Many German firms keep such stocks for months at an interest rate of from 9 to 14 per cent; stocks abroad are kept for 8 to 15 days at an interest rate of 2 per cent."

Professor Schlesinger, of Charlottenburg Technische Hochschule, returning from a trip through Russia, reported that one of the biggest industries in Russia is the machinery and tool branch.

Hartford to Resume Machinist Schools

A committee from the Manufacturers' Association together with Superintendent of Schools Fred D. Wish, Jr., and L. W. Wheelock, vocational director, met recently to discuss proposed extensions to the Hartford Trade School. The plan is to give part-time instructions to machinist apprentices working in local factories. The course will probably be arranged to give four hours of study weekly on technical points about the work.

No definite action was taken and the meeting consisted chiefly of formulating plans. The matter will no doubt be acted upon at the next meeting of the Manufacturers' Association.

The committee from the association was made up as follows: Chairman, Lucius Rossiter, vice-president and treasurer of the Terry Steam Turbine Co.; Arthur W. Fox, general manager and director of the Billings & Spencer Co.; Charles D. Rice, superintendent of the Underwood Typewriter Co.; and Clayton R. Burt, general manager of the Pratt & Whitney Manufacturing Co.

It is practically assured that machine work classes will be established, or rather reestablished, since previous to the war a school of this kind was conducted in Hartford.

May Sell Machine Tools to Cuba

Machine tools and automotive repair shop equipment can be sold to Cuba by the Ordnance Department under legislation which has been approved by the Military Affairs Committee of the Senate.

Under existing law the War Department may sell offensive military equipment to the Cuban government, but under the amendment now proposed any item under "individual and organization equipment" may be included.

This item includes mechanical equipment essential to the maintenance of ordnance.

News of the Automotive Industry

The Ford Motor Co.'s production in 1925 totaled 2,103,588 cars, trucks, tractors and airplanes. Exclusive of airplanes, this is an increase of 20,033 over 1924. Domestic production of cars and trucks totaled 1,775,245. Foreign production totaled 136,461 cars and trucks. Ford of Canada production was 79,289. Tractor production was 104,168. Production of Lincoln cars was 8,415.

Since the airplane factory was taken over on Aug. 1, production has been 10 all-metal planes.

Stockholders of the Flint Motors Co., are considering an amendment to the company's charter authorizing the directors to mortgage the property in Flint and Lansing. It is understood the directors plan to issue $4,000,000 in bonds to furnish additional working capital.

The Chevrolet Motor Car Co. will bring out a new line of models embodying improvements in the chassis and paint work. A feature will be the addition of a new Landau model.

The Oakland Motor Car Co., completed its expansion program at the end of 1925 in preparation for a capacity production of 1,000 cars a day beginning in April. The scheduled production calls for a daily output of 500 Oakland Sixes besides 500 Pontiac Sixes.

Buick's new engine plant, the first step in its $2,000,000 expansion program is nearly completed. This will enlarge capacity to 1,200 cars a day. When the expansion program is entirely completed the company will have a yearly capacity of 300,000 cars.

Acquisition of the Symington Gun plant in Rochester, N. Y., by Locke & Co., of Detroit, led to the announcement by the Chamber of Commerce officials that the automobile body manufacturers would come to Rochester. It was said the factory would be opened within two weeks, employing about one thousand men. Twenty-four departmental heads will be brought from Detroit, but the working force will be obtained in Rochester.

The building of 1,500,000 Dodge Brothers motor cars has been completed, eleven years and two months after the first car bearing the name rolled from the assembly line. The last 100,000 were built in five months and nine days; the first 100,000 in a few days less than two years.

What the Railroads Are Doing

Exports of locomotives for the first 11 months of 1925 amounted to 325 units, valued at $6,309,263, against 295 locomotives, valued at $5,068,818, in the corresponding period of 1924. Brazil was the best customer during the year, taking 86 locomotives, valued at $1,945,094.

The Baldwin Locomotive Co. has received an order from the Pennsylvania Railroad for 100 locomotive tenders.

The Pullman Car and Manufacturing Corporation has been awarded orders for freight cars costing approximately $5,000,000.

The Southern Pacific Railway has awarded orders for 2,000 cars as follows: 500 ballast cars to the Pullman Co., 500 ballast cars to the American Car and Foundry, 700 all-steel auto cars to the General American Tank Car Corporation and 300 auto cars to the Pennsylvania Car Co.

The Atchison, Topeka & Santa Fé R.R. will spend approximately $67,250,000 for equipment, extensions and betterments in 1926, compared with $60,100,000 in 1925.

A budget of $23,500,000 for improvements has been authorized, which will be lumped with a carry-over of $25,000,000, representing like expenditures authorized but not used in 1925.

The Pennsylvania Railroad has placed orders with the Carnegie Steel Co. for 100,000 steel car wheels.

A gas-electric car with a luggage compartment has been placed in service on the Trenton branch of the Reading Railroad. It has accommodations for fifty-five passengers. The gas-electric has replaced two Class Q-1 2-6-4 steam locomotives and one coach.

The Baltimore & Ohio R.R. has purchased 1,000 hopper cars from the Standard Steel Car Co., 1,000 hoppers from the Bethlehem Steel Corporation, 40 passenger cars from the Pullman Car and Manufacturing Co., 18 passenger cars from the American Car and Foundry Co., and 15 passenger cars from the Bethlehem Steel Co.

The Union Pacific R.R. has ordered 500 ballast and 30 passenger cars from the Pullman Car and Manufacturing Co., 500 ballast and 17 passenger cars from the American Car and Foundry Co., 700 automobile cars from the General American Tank Car Co., and 300 automobile cars from the Pennsylvania Car Co.

The plan for forming a new Brill Corporation to control the J. G. Brill Co. and the American Car and Foundry Motors Co. was declared operative on Jan 19.

The motors company owns the Hall Scott Motor Car Co., of California and has 90 per cent control of the Fageol Motors Co., of Ohio.

British Industries Fair Invites the World

A convincing contradiction to the depressing reports regarding the state of British industry, which have been current recently, is supplied by the British Industries Fair, to which the British government has just sent out official invitations to over 50,000 of the most important firms of the world.

Much interest has been aroused by the recent decision of the British government to issue "gratis" visas to all "bona fide" buyers traveling to England to attend the fair. Requests for invitations are being received in large numbers at the various British Consulates which are authorized to issue official invitation cards.

The fair takes place simultaneously in London and Birmingham, from Feb. 15 to 26. This year its sixth anniversary will be celebrated by a State Banquet for representative exhibitors and buyers, which the Prince of Wales will officially attend.

I. H. Thedieck Dead at Sidney

I. H. Thedieck, president of the Sidney Machine Tool Co., of Sidney, Ohio, died in a hospital in Columbus on Jan. 20. Mr. Thedieck had been ill but a short time and his death was quite unexpected. He was seventy-one years old.

I. H. Thedieck was one of the best known machinery and machine tool builders in the country. He became associated with the Sidney company in 1914, as president of the board of directors. He was a prominent citizen of Sidney, having conducted a large department store in that city for the past fifty years. He was also president of the Monarch Machine Tool Co. and a director in several corporations including the Whipp Machine Tool Co., the Anderson Body Co., and the Sidney Telephone Co.

Personals

PATRICK JORDAN has resigned as superintendent of the Athol Machine and Foundry Co., Athol, Mass.

L. S. BELDING, who has joined the Electric Service Supplies Co., will cover Ohio and part of Michigan.

R. A. RAWSON has been appointed general manager of the Stutz factory at Indianapolis.

L. A. SCHMIDT has been appointed chief engineer and assistant to the president of the Locomobile Co. of America.

CHARLES T. TREADWELL, an official of the New Departure Co., Bristol, Conn., has been elected a director of the Russell Manufacturing Co. of Middletown, Conn.

ERNEST WOOLER has been appointed chief engineer of the Timken Roller Bearing Co., of Canton, Ohio. He was formerly automotive engineer of the company.

CHARLES J. BRICKLEY has become associated with the Electric Service Supplies Co. of Chicago. He will cover the state of Wisconsin and upper Michigan.

ARTHUR C. PLETZ, of the Morris Machine Tool Co., of Cincinnati, has been elected president of the Foreign Trade Association of the Cincinnati Chamber of Commerce.

R. CHARLES BROWER has been appointed assistant to the vice-president in charge of sales of the Timken Roller Bearing Co., of Canton, Ohio. He has been assistant general manager of the company.

M. J. MILLER has been appointed sales engineer in charge of the Detroit district for the Diamond Power Specialty Corporation, of Detroit. Mr. Miller has been manager of the Philadelphia branch of the company.

JOHN ANDREWS, JR., formerly manager of the Cleveland branch office of the Westinghouse Electric and Manufacturing Co., has been made manager of the Detroit district office. He succeeds C. C. Owens who has resigned.

J. E. COOPER, vice-president, and R. E. PRICHARD, assistant treasurer, of the Stanley works, New Britain, Conn., left recently for Belgium, where details for the establishment of a European branch will be made.

NORMAN R. KETTERING, of Anderson, Ind., former general superintendent of the Remy Electric Co., has been appointed chief engineer for construction and plant engineering for the General Motors Corporation, export division.

GEORGE T. AITKEN, formerly sales manager of the Vonnegut Machinery Co., of Indianapolis, has been appointed manager of the machine tool motor sales department in the electrical division of Fairbanks, Morse & Co., with headquarters at Indianapolis.

J. W. SPRAY has been appointed manager of sales for the Timken Roller Bearing Co., of Canton, Ohio. E. W. Austin has been appointed assistant to Mr. Spray. Both Mr. Spray and Mr. Austin have been district managers for the Timken company, the former in Detroit and the latter in Cleveland.

G. R. SCOTT has become connected with the Electric Service Supplies Co., of Chicago. Mr. Scott has been variously connected with the Electrical Engineering Co., St. Paul Electric, Ft. Wayne Electric Wks., General Electric Co. and recently has been district manager of sales in Chicago for the Jeffrey-DeWitt Insulator Co.

Business Items

The Wagner Electric Corporation announces the removal of its Omaha office to 2566 Leavenworth St.

The General Stamping Co., of Cleveland, Ohio, has been organized to manufacture dies, tools and machinery.

The Barrett-Cravens Co., of Chicago, has purchased the building at 30th St. and Spaulding Ave., Chicago, containing 73,000 sq.ft. of floor space.

The Argos Foundry Co., Inc., has been incorporated at Argus, Ind., to manufacture iron, brass, aluminum and other metal products.

Wilson & Brown, machine tool dealers, of 2 Rector St., New York, have been appointed New York district representatives for Colburn high power drills and milling machines.

The Eshenower & Hatmaker Machine Tool Works, Inc., has been reorganized and incorporated at Harrisburg, Pa. The company will continue to specialize in the machining of manganese and forged steels.

The F. F. Barber Machinery Co., Ltd., of Toronto, Ontario, Canada, has been appointed exclusive representative in the Province of Ontario for the Geometric Tool Co., of New Haven, Conn.

The National Twist Drill and Tool Co., of Detroit, announces the election of the following officers: William H. McGregor, chairman of the board; H. L. McGregor, president; C. Earle Smith, vice-president and manager of sales.

A controlling interest in the A. M. Chapel Machine Co., Pittsfield, Mass., has been acquired by James Bowe, who has been superintendent of the company's foundry since 1907. Mr. Bowe assumes the office of treasurer.

The Holyoke Co., Inc., of Holyoke, Mass., has completed final arrangements for the purchase of the plant of the Century Machinery Co., and will start the manufacture of wire. This business was formerly conducted by the Prentiss Wire Mills.

The Nazel Engineering and Machine Works, of Philadelphia, Pa., has purchased from the T. C. Dill Machine Co., all rights and titles to the Dill slotter, and will manufacture that machine together with the regular Nazel products.

Frank Diehl, Inc., has been incorporated at Wabash, Ind., for the purpose of manufacturing and selling wood-working tools and machinery. The company has no connection with the Diehl Machine Works, at Wabash.

The Erie Foundry Co., of Erie, Pa., has established three branch offices as follows: Plainfield, N. J., at 1120 Myrtle Ave., in charge of Howard Terhune; Chicago, at 549 Washington Blvd., in charge of L. F. Carlton; Detroit, at 408 Donovan Bldg., in charge of R. B. McDonald.

Closing of a contract by the L. G. S. Devices Corporation, of Indianapolis, with the General Motors Corporation, by which General Motors acquires the rights to manufacture and use or sell to other companies for use on automobiles and airplanes, a newly developed clutch drive mechanism, has been announced by officers of the former corporation.

Branch office managers, sales representatives and distributing agents for the Master Electric Co., of Dayton, Ohio, met at the factory in that city on Jan. 11 and 12 for the annual sales conference. One of the objects of the conference was to acquaint the staff with the facilities of the company's new plant at Linden and Master Avenues. Sales plans for the year were outlined and other business matters were discussed.

During the week of Jan. 4 the Abrasive Co. held its annual sales conference at the Philadelphia plant. Plans for the current year were reviewed and unanimously approved by the sales representatives present. The conference sessions were presided over by Edward W. Dodge, sales manager.

Among the representatives present were: M. R. Clark and C. B. Yeomans, Cleveland; B. S. Coop, Atlanta; A. B. Davenport, Jr., Pittsburgh; F. G. Dowling, San Francisco; Dwight W. Grover, New York City; J. G. Herold, Dayton; W. A. MacFarland, A. T. Hughes, W. A. McMillan, A. J. Lewis, Detroit; L. R. Kerns, Grand Rapids; P. R. Ketzer, L. J. Musser, R. R. Stagmer, E. M. Wilkinson, W. W. Wilson, Philadelphia; A. M. Leverich, Milwaukee; Edward J. Kelly, Adrian; J. Carl Snyder, Buffalo; T. B. Woodrow, Indianapolis; R. H. White, Hamilton, Ontario.

Obituaries

CARTER MILLER, manager of advertising and sales promotion for the Timken Roller Bearing Co., of Canton, Ohio, is dead.

ALPHONZO B. BOWERS, inventor of the centrifugal hydraulic pump and dredger, died at his home in Lynn, Mass., on Jan. 24. He was 96 years old.

GEORGE W. ROBERTS, wire manufacturer, of Lee, Mass., died suddenly on Jan. 16. Mr. Roberts established the Thistle Wire Works at Lee, of which he was the owner.

EDWARD C. FLETCHER, one of the organizers of the Diamond Chain Co. of Indianapolis, died recently after an illness of two days. He was 56 years old.

ALBERT BRODEN, former president of the Eastern Pig Iron Association, and long identified with the iron and steel industries in this country, died at his home in Reading, Pa., on Jan. 17. He was 76 years old.

Forthcoming Meetings

Society of Automotive Engineers. Annual meeting, General Motors Bldg., Detroit, Jan. 26 to 29. Coker F. Clarkson, secretary and general manager, 29 West 39th St., New York City.

Engineering Institute of Canada. Annual meeting, King Edward Hotel, Toronto, Canada, Jan. 27, 28 and 29. Chairman, C. A. Meadows, 479 Wellington St., W., Toronto, Canada.

National Railway Appliance Association. Annual meeting and exhibition, Coliseum and Annex, Chicago, March 8 to 11th. C. W. Kelley, secretary, 845 So. Wabash Ave., Chicago.

National Foreign Trade Council. Thirteenth national foreign trade convention, Charleston, S. C., April 28, 29 and 30. O. K. Davis, secretary, India House, Hanover Square, New York.

American Gear Manufacturers' Association. Tenth annual meeting, Book-Cadillac Hotel, Detroit, May 13, 14 and 15. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

American Supply and Machinery Manufacturers' Association. Annual convention, Hotel Statler, St. Louis, week of May 17. F. D. Mitchell, secretary, 1819 Broadway, New York.

National Association of Purchasing Agents. Eleventh annual convention and exposition, Ambassador Hotel and Auditorium, Los Angeles, Calif., June 9 to 12. W. L. Chandler, secretary, Woolworth Bldg., New York.

American Society for Testing Materials. Twenty-ninth annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., June 21 to 25. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Pig-iron demand continues slow; production is active on orders for first quarter delivery. The finished steel market reflects conditions in iron. Steel plates, sheets, and scrap are weaker as to price; coke is tending upward. Mill quotations are: bars, $2@$2.10; shapes, $1.90 @$2; plates, $1.85@$1.90 per 100 lb., Pittsburgh; the last mentioned being the weakest of the three.

Non-Ferrous Materials—Tin and antimony are down 1c. and lead ¼c. per lb. at New York warehouses, compared with the Jan. 8 level. Fabricated brass and copper tend downward in Chicago. Price of linseed oil is 0.3c. per lb. below the Dec. 31 level at New York and Minneapolis. Recent general reduction of 1c. per lb. occurred in aluminum ingots.

(All prices as of Jan. 22)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.05
Northern Basic	24.27
Southern Ohio No. 2	24.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.37
BIRMINGHAM	
No. 2 Foundry	22.00@23.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.16
Virginia No. 2	29.17
Basic	23.16
CHICAGO	
No. 2 Foundry local	23.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	26.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	22.27
Basic	22.27
Bessemer	22.27

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00@5.50
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.50	3.89	3.25	3.50
No. 12	2.55	3.94	3.30	3.55
No. 14	2.60	3.99	3.35	3.60
No. 16	2.70	4.09	3.45	3.70
Black				
Nos. 18 to 20	3.15	4.15	3.90	3.90
Nos. 22 to 24	3.20	4.20	3.95	3.95
Nos. 26 and 27	3.25	4.25	4.00	4.00
No. 28	3.35	4.35	4.10	4.10
Galvanized				
No. 10	3.60	4.35	4.25	4.25
Nos. 12 to 14	3.70	4.45	4.35	4.35
No. 16	3.85	4.60	4.50	4.50
Nos. 18 to 20	4.00	4.75	4.65	4.65
Nos. 22 to 24	4.15	4.90	4.85	4.80
Nos. 26 and 27	4.30	5.05	5.10	4.95
No. 28	4.60	5.35	5.25	5.25

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameters Inches External	Diameters Inches Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness B.W.G. and Decimal	Fractions	Outside Diameter in Inches ⅛	¼	⅜	½	1	1¼	1½
		Price per Foot						
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049″	18	.17	.18	.19	.20	.21	.23	.25
.065″	16	.19	.20	.21	.22	.23	.25	.27
.083″	14	.20	.22	.23	.24	.25	.27	.29
.095″	13	.21	.23	.25	.26	.27	.29	.31
.109″	12	.22	.24	.26	.27	.28	.30	.32
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33
.134″	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	7.00	6.00@7.50	4.65†
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.85	4.15
Cold rolled strip steel	6.35	6.35	6.80
Floor plates	5.55	5.60	5.50
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.10
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.40	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	50@60%	55%	60%

Electric welding wire, New York, $\frac{3}{32}$, 8.25c.; $\frac{1}{8}$, 7.85c.; $\frac{5}{32}$ to $\frac{1}{4}$, 7.35c. per lb. *Flat, $\frac{1}{16}$@$\frac{1}{2}$-in. thick. †F.o.b. cars.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.00
Tin, 5-ton lots, New York			63.00
Lead (up to carlots) E. St. Louis	9.10	New York	9.75
Zinc (up to carlots) E. St. Louis	8.40	New York	9.75

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	25.00	24.50	26.00
Copper sheets, base	22.50	22.50	22.50
Copper wire, base	19.62½	16.50	16.25@16.50
Copper bars, base	22.12½	22.37½	22.12½
Copper tubing, base	24.50	24.50	24.50
Brass sheets, base	19.12½	18.87½	19.12½
Brass tubing, base	23.75	23.50	23.75
Brass rods, base	16.87½	16.62½	16.87½
Brass wire, base	19.62½	19.37½	19.62½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	27.00	27.00	27.02
Zinc sheets (casks)	12.00	12.60@12.95	12.27
Solder (½ and ½), (case lots)	40.25	41.00	38@42

Babbitt metal, delivered, New York, cents per lb.:

Genuine, highest grade	80.62½
Commercial genuine, intermediate grade	56.00
Anti-friction metal, general service	31.50
No. 4 babbitt (f.o.b.)	14.50

Nickel, f.o.b. refinery, cents per lb.: Ingots 31.00 Electrolytic 38.00 Shot 32.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
Cold rolled sheets (base)			50.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.12½@12.25	11.25	11.50@12.00
Copper, heavy, and wire	11.75@12.00	11.50	11.25@11.75
Copper, light, and bottoms	9.75@10.25	9.50	10.00@10.50
Heavy lead	8.00@8.37½	7.50	7.75@8.25
Tea lead	6.25@6.50	5.00	6.75@7.25
Brass, heavy, yellow	7.25@7.75	7.25	7.50@8.00
Brass, heavy, red	9.50@10.00	9.50	8.75@9.25
Brass, light	6.00@6.50	6.00	7.25@7.75
No. 1 yellow rod turnings	8.50@9.00	8.00	7.75@8.25
Zinc	4.75@5.25	4.75	5.25@5.75

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade: IC,	14x20	$11.25	$11.45	$11.50
"A" Grade: IC,	14x20	8.85	9.40	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.85	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.20
Cotton waste, colored, per lb.	.10@.15½	.10	.17
Wiping cloths, washed white, per lb	.18	36.00 per M	.16
Sal soda, per 100 lb. keg	2.25	2.25	2.75*
Roll sulphur, per 100 lb. keg	3.75	3.35	4.50
Linseed oil, per gal., 5 bbl. lots	.89½	1.05	.99
Lard cutting oil, 25% lard, per gal.	.55	.50	.56
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.35	.35	.29

Belting—Present discounts from list in fair quantities (½ doz. rolls).

Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
*Second grade	50–10%	60–5%	50–10%

*In 175 lb. kegs.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.0415
Brass rods	per lb	.1687½	.1687½	.1762½
Solder (½ and ½)	per lb.	.4025	.4025	.42½@.43½
Cotton waste	per lb.	.15@.22	.15@.22	.15@22
Washers, cast iron (⅛ in.)	per 100 lb.	7.00	7.00	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.55	3.55	3.38
Lard cutting oil	per gal.	.55	.55	.60
Machine oil	per gal.	.35	.35	.29
Belting, leather, medium	off list	40–5%	40–5%	40–2½%
Machine bolts up to 1x30 in.	off list	40%	40%	45%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.56	$5.84	$5.65
Emery paper	10.71	11.00	10.71
Emery cloth	29.48	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.45	1.49
Cloth	3.55	3.55	3.20
Fire clay, per 100 lb. bag		.60	.75
Coke, prompt furnace, Connellsville	per net ton		9.50@10.00
Coke, prompt foundry, Connellsville	per net ton		9.50@10.00
White lead, dry or in oil	100 lb. kegs		New York, 15.25
Red lead, dry	100 lb. kegs		New York, 15.25
Red lead, in oil	100 lb. kegs		New York, 16.75

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1¼x¼-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ¼x¼-in., 2c. each. Discount 70% for $\frac{5}{16}$-in. and smaller and 65% for ⅜-in. and larger.
Case hardened ¼x¼-in., 6c. each, less 50%.

Rivets, button heads, ⅜-in., ½-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4½-in. $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb, less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ⅝-in. dia., 35c.; ¾-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

Washers, cast iron, ⅜-in., $7.00* per 100 lb. at New York warehouses; ½-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Calif., Centerville — Washington Union High School Dist.—shop equipment for proposed addition to high school. Estimated cost $11,000.

Ill., Chicago—Battey & Kipp, 123 West Madison St., is receiving bids for machine tools for locomotive shops of the Florida East Coast Ry. Co., St. Augustine, Fla., plant.

N. J., Trenton—Essex Rubber Co., C. H. Oakley, Pres., Beakes and May Sts.—machinery for proposed machine shop, etc., to replace fire loss.

N. Y., Long Island City—Epiphone Banjo Co., 35 Wilburn Ave.—electric butt welding machine.

N. Y., New York—Segal Lock Co., 159 Leonard St.—precision bench lathe, Rhodes shaper.

O., Dover—Reeves Mfg. Co.—No. 3 Bliss wiring press, No. 21½ fly-wheel press, No. 40 Horning press and two 30 or 36 in. power squaring shears.

O., Toledo—Bunting Brass & Bronze Co., Spencer and Carlton Sts.—geared punch press.

Pa., Manheim—Bond Foundry & Machine Co.—24 in. bevel gear planer.

Pa., Reading — Reading Engineering Works, 32 North Second St.—rotary tube mill.

Pa., Pittsburgh—The Pittsburgh & Lake Erie R.R., Pittsburgh & Lake Erie Terminal Bldg., C. M. Yohe, Purch. Agt.—100 in. boring wheel.

Ont., London — Kelvinator of Canada Ltd., 518 Pitt St. W., Windsor—equipment for recently acquired plant for manufacture of electric refrigerators, here. Estimated cost $100,000.

Ont., Toronto—Bd. of Education, 155 College St.—equipment for machine shops, for 3 story technical school. Total estimated cost $1,000,000.

Que., Cartierville—I. Rohtaiele (garage) small bench lathe and miscellaneous tools.

Opportunities for Future Business

Calif., Fresno—Southern Pacific Co., 65 Market St., San Francisco, plans the construction of a machine shop, round house, etc., here. Estimated cost $1,500,000. G. W. Boschke, Ch. Engr.

Calif., Los Angeles—Advance Auto Body Works, 515 Mission Road, is having plans prepared for the construction of 2 story, 125 x 156 and 30 x 40 ft. factory buildings at Macy St. and Mission Road. Estimated cost $100,000. H. E. Bean, Central Bldg., Archt. Noted Nov. 26.

Calif., Oakland — Electrical Products Corp., 30th and Myrtle Sts., awarded contract for the construction of addition to factory. $17,500.

Calif., Sacramento—American Can Co., 3rd and 22nd Sts., San Francisco, awarded contract for the construction of a 1 story can factory here. $1,000,000.

Calif., San Francisco—Western Furnace & Cornice Works, 202 Brannan St., will build a 1 story shop at Essex and Lansing Sts. Estimated cost $5,000.

Conn., Bridgeport—Mack Motor Co., 673 Connecticut Ave., will receive bids until Feb. 1 for the superstructure of a 1 story, 175 x 196 ft. garage and service station on Ash Creek. Estimated cost $150,000. Warren Engineering Co., Terminal St., Boston, Mass., Archts. and Engrs. Noted Dec. 31.

Conn., Bristol—New Departure Mfg. Co., 269 North Main St., awarded contract for the construction of a 70 x 240 ft. addition to forge shop on Terryville Ave. Estimated cost $40,000. Noted Jan. 14.

Conn., New Britain—American Hardware Corp., 10 Franklin Square, had plans prepared for the construction of a 2 story, 30 x 60 ft. office and factory building on Washington St. Estimated cost $125,000.

Conn., New Britain—Russell & Irwin Mfg. Co., Washington St., dock manufacturers, awarded contract for the construction of a 2 story factory at Myrtle and Lafayettes Sts. Estimated cost $125,000.

Conn., Southington—Peck, Stow & Wilcox, has work underway on the construction of a 4 story, 50 x 100 ft. machine shop. Noted Dec. 10.

Fla., Coral Gables—E. K. Lowe, awarded contract for the construction of a 2 story machine shop. $40,000.

Fla., Tampa—Solar Water Heater Co., awarded contract for the construction of first unit to plant, 100 x 100 ft. $60,000.

Ill., Melrose Park—Electrical Engineers Equipment Co., awarded contract for the design and construction of a factory and office building to Stone & Webster, Inc., 38 South Dearborn St., Chicago. Estimated cost $250,000.

Ind., South Bend — Studebaker Corp., Main and Bronson Sts., awarded contract for the construction of a 1 story, 124 x 382 ft. spring factory. Estimated cost $125,000.

Ia., Marshalltown — Marshalltown Mfg. Co., F. M. Farber, Secy. and Treas., manufacturers of gages, shears, bending rolls, flue welders, etc., will build a 3 story, 60 x 75 ft. addition to plant.

La., New Orleans—E. A. Christy, 302 Walnut St., Supervising Archt., will receive bids until Feb. 12 for the construction of a 3 story school including shops, etc., at Tonti, Onzago, D'Abadie and Rocheblave Sts. for Orleans Parish School Board, City Hall Annex. Estimated cost $250,000.

Mass., Norfolk Downs (Boston P. O.) — Pneumatic Scale Corp., N. S. Ross, Purch. Agt., 65 Newport Ave., Quincy, plans the construction of a 3 story addition to factory here. Estimated cost $50,000. Architect not selected.

Mich., Detroit—Detroit City Gas Co., Clifford and Bagley Aves., awarded contract for the construction of a 3 story, 160 x 198 ft. garage and service station at Sixth and Noble Sts. Estimated cost $150,000.

Mich., Detroit—Hudson Motor Car Co., 12601 East Jefferson Ave., awarded contract for the construction of a 1 story, 150 x 340 ft. addition to building C. Noted Jan. 14.

Mich., Detroit—Packard Motor Car Co., East Grand Blvd., will soon award contract for the construction of a 2 story, 131 x 147 ft. service building on Hague Ave. Estimated cost $150,000. A. Kahn, 1000 Marquette Bldg., Archt. Noted Aug. 13.

Mich., River Rouge (Detroit P. O.) — Ford Motor Co., Woodward Ave., Highland Park, awarded contract for the construction of a 1 story, 400 x 663 ft. addition to motors building here. Estimated cost $1,500,000. Noted Dec. 3.

Minn., St. Paul—Auto Engine Works, Griggs St. and University Ave., is having plans prepared for the construction of a 1 and 2 story, 140 x 205 ft. factory and machine shop at St. Anthony and Hamline Aves. Estimated cost $65,000. J. W. Stevens, 907 Exchange Bank Bldg., Archt.

Mo., Kansas City—H. F. Hoffman, Trenton, plans the construction of a 2 story, 57 x 150 ft. garage and machine shop at 36th St. and Broadway, here. Private plans.

Mo., Kansas City — Kansas City Hay Press Co., 4th St. Viaduct, will build a 1 story, 70 x 180 ft. machine shop. Estimated cost $20,000.

N. J., Trenton—Essex Rubber Co., C. H. Oakley, Pres., Beakes and May Sts., plans the construction of a machine shop, finishing and inspecting departments to replace fire loss. Estimated cost $200,000. Architect not selected.

N. Y., Buffalo—American Radiator Co., 1807 Elmwood Ave., plans the construction of additions to core room and foundry. Estimated cost $1,500,000. Private plans.

N. Y., New York—F. A. D. Andrea, Inc., 1581 Jerome Ave., is having plans prepared for the construction of a radio plant at 138th St. and Mott Ave. Estimated cost $750,000. Ballinger Co., 100 East 42nd St., Archt.

O., Cleveland—The Cleveland Automobile Co., J. J. Krall, Secy. and Treas., London Road, had plans prepared for the construction of a 1 story, 120 x 180 ft. addition to factory. Estimated cost $100,000. E. McGeorge, 3030 Euclid Ave., Archt.

O., Cleveland—The Dill Mfg. Co., A. B. Bronson, Secy., 694 East 82nd St., manufacturers of metal stampings, awarded contract for the construction of a 4 story, 46 x 80 ft. addition to factory. Estimated cost $50,000.

O., Cleveland—A. A. Kerr, 1301 Chester Ave., awarded contract for the construction of a 5 story, 100 x 130 ft. garage on East 12th St. Estimated cost $300,000.

O., Cleveland—The Morgan Brass Co., L. Stern, Secy., 2104 Woodland Ave., awarded contract for the construction of a 1 story, 100 x 200 ft. foundry and machine shop. Estimated cost $75,000. Noted Nov. 19.

O., Cleveland—W. S. Tyler Co., C. Zimmerman, Secy. and Treas., 3615 Superior Ave. (ornamental iron and bronze work), awarded contract for the construction of a 6 story, 82 x 118 ft. factory at East 34th St. and Superior Ave. Estimated cost $300,00. Noted Jan. 14.

O., Youngstown—John H. Fitch Co., F. G. King, Pres., 304 Mahoning St., is having plans prepared for the construction of a 5 story, 63 x 250 ft. garage and service station on Wick Ave. Estimated cost $400,000. M. W. Scheibel, Realty Bldg., Archt. Shanks & Foster, 6007 Euclid Ave., Cleveland, Engrs.

O., Zanesville—Federal Radiator Co. is having plans prepared for the construction of a 42 x 300 ft. addition to plant. Estimated cost $125,000.

Pa., Pittsburgh—Lustro Coated Sheet Co., 1312 Sheffield St., awarded contract for the construction of a 1 story, 100 x 200 ft. plant for the manufacture of nickel and copper plated steel on Ridge Ave. Estimated cost $50,000. Noted Jan. 14.

Tenn., Chattanooga — Corley Mfg. Co., 1901 Williams St., awarded contract for the construction of a foundry and machine shop. $30,000. Noted Dec. 17.

Tex., Cleburne—Gulf, Colorado & Santa Fe Ry. Co., Railway Exchange Bldg., Chicago, Ill., will receive bids about Feb. 1 for the construction of a group of buildings including blacksmith shop, flue shop, etc., here. Estimated cost $300,000. F. Merritt, Union Depot Bldg., Galveston, Tex., Ch. Engr.

Wash., Seattle—J. Graham, Dexter Horton Bldg., Archt., will receive bids about Mar. 12 for the construction of a 5 story, 100 x 200 ft. lock manufacturing plant for Best Universal Lock Co., 1121 Post St. Estimated cost $250,000.

W. Va., Huntington—International Nickel Co., Guyan River Road, awarded contract for the construction of a 65 x 275 ft. addition to plant.

Wis., Green Bay—Northwest Engineering Works, Howard St., awarded contract for the construction of a 1 story, 42 x 70 ft. addition to shop. Estimated cost $25,000. Noted Aug. 6.